# Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LVI. NEW YORK, THURSDAY, SEPTEMBER 22, 1910. No. 12.

PUBLISHED WEEKLY BY THE

## McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK

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TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All Other Countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.



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Entered as second-class matter at the post office at New York, N. Y.

*The circulation of Electrical World for 1909 was 945,850. Or this issue, 16,500 copies are printed.*

NEW YORK, THURSDAY, SEPTEMBER 22, 1910.


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## THE ELECTRIC LIGHT CONVENTIONS.

Elsewhere we print accounts of two of the most successful electric light conventions of the year, namely the semi-annual meeting of the New England Section of the National Electric Light Association, and the annual meeting of the Pennsylvania Electric Association, a body also affiliated with the national body. If the value of state and sectional electric light organizations needed demonstration, the proceedings of the present meetings appear to indicate clearly the extreme usefulness of such bodies when their program is confined to the specific discussion of electric light situations actually confronting their members. One of the good effects of their affiliation with the national organization is that many matters which formerly figured on their programs and not of pressing or timely importance, or which for proper treatment require systematic investigation such as only the resources of the greater body can command, may now be left for consideration at the annual N. E. L. A. convention. Many matters most vitally affecting central stations acquire different aspects in different sections of the country, and if they are to be treated specifically rather than in general terms, they must be considered so far as possible with relation to local conditions. We need merely point to the vastly different conditions in regard to rate-making, for example, in a state like Wisconsin or New York, and in one like Pennsylvania or Rhode Island. Affiliation with the National Electric Light Association has been viewed with apprehension by some state organizations, as likely to circumscribe their activities. If we are to judge from the two meetings of last week, such affiliation has, in fact, resulted in a vast extension of activity of a kind most beneficial to the central stations represented.

Naturally the question of rate-making occupied a prominent place on both programs, and quite naturally also its discussion developed the usual diversity of opinion. The introduction of the tungsten lamp has brought more attention to bear on the subject of rate-making than it received in the previous central-station period of twenty years or more, but little has thus far resulted practically from the discussion of the question during the past several years. Possibly one reason for this condition is that the end sought has been a uniform rate system of general application—one which can be everywhere applied and by the smallest as well as by the largest central stations. The present as well as other recent discussions of the question seem to indicate clearly the impossibility of devising any system of rates that will attain this ideal. Nevertheless, we hope the subject will continue to be the leading one at electric light meetings, in order that all the principles involved in rational rate-making may become clearly defined and co-ordinated, not only for the instruction of central-station men, but through them in turn, for the instruction of the public. Competition, franchises, ordinances public utility regulation, local feeling and other considerations will determine how nearly a system devised to be strictly fair to the central station as well as to the public can be introduced; but the central-station man should be conversant with all the principles involved in rate-making, in order to know how to formulate

intelligently a system best adapted to his local conditions. Mr. Blood in his remarks at the New England meeting touched on this phase of the matter when he said that actual rates should not be discussed so much as the underlying principles of charging; and as a basis for dealing with the public on the subject of rate-making he pointed out the desirability of educating it to the fact that the central station does not deal in a commodity but in a service. Any rational rate system must be based upon the idea of service, and consequently the desirability of educating the public to this idea should be thoroughly recognized by the central-station man. We regret that space will not permit touching on other interesting features of the two conventions, but in closing we cannot refrain from reference to the surprising objection—especially from the central-station standpoint—offered at one of the meetings to the tungsten lamp on the grounds that "it has a tendency to over-illuminate, because customers substitute a large clear-bulb tungsten for the ordinary 16-cp carbon lamp!" Evidently there are some central-station men who are not in sympathy with the slogan, "More light for the same money."

## COMPARATIVE LIFE TESTS OF INCANDESCENT LAMPS.

If the opinion of the ordinary householder were asked as to the longevity of the incandescent lamp he operates from lighting mains, he would probably say that no law existed in the matter and that it was almost as much a question of chance as in throwing dice, especially when tungsten lamps were used subject to severe handling. The ordinary householder, however, rarely records his lamp-hours, seldom inspects his renewals, ignores sudden death caused by accidental breakages, and does not always enjoy a very nearly uniform potential difference at his lamp terminals. When, on the other hand, lamps of the same batch in manufacture are submitted to careful inspection for defects, are next carefully measured for specific consumption, and are then counted out for working hours to 80 per cent of initial mean horizontal candle-power, on mains of carefully maintained pressure, it is remarkable how closely they will agree.

It is a common colloquialism to say "as like as two peas" when we connote a high degree of quantitative similarity, but anyone who has made a careful examination of peas, as they come fresh and unassorted from the garden without being subjected to the demeaning influence of the sieve, knows that the average pea is remarkably different from its neighbor. What we ought to say on such an occasion is "as like as two incandescent lamps after being sorted in a testing laboratory." Unfortunately, the metaphor was stereotyped before the incandescent lamp illumined a benighted vegetable market. In fact, we can truthfully go further and say that the determination of the average lifetime of incandescent lamps, under scientific methods of testing, demands a higher precision in voltage and voltmeters than any other electrical industry, a tenth of 1 per cent being a quantity to be reckoned with. Something of the same precision quality is the joint property of large groups of similar human beings. An individual does not possess the property of precision in duration of life. The individual may die in early youth or survive a century. Nevertheless, a large community of individuals living in unchanged conditions possesses jointly this remarkable property of dying at a definite predeterminable age. The precision with which a million people die at an average predetermined age is worthy of the highest admiration. But in order to attain this precision the records must be kept with scientific care.

On page 665 of this week's number appears an interesting article by Messrs. Clayton H. Sharp and Preston S. Millar on the subject of comparative life tests of incandescent lamps. In this article attention is called not only to the agreement between the average lifetimes of twin lamp-batches in the same testing laboratory, but also to the agreement between average lifetimes of twin lamp-batches, as compared in different laboratories on opposite sides of the Atlantic. It is shown that the average disagreement between average group lifetimes is about 1.5 per cent when the number in each group is from 100 to 300, about 3 per cent when the number is from 50 to 100, and about 4.5 per cent when the number is from twenty to fifty. According to the theory of purely accidental errors, the increase in precision with the size of the group should be more marked than these numbers would indicate, so that other sources of disparity may be suspected. The agreement between the average lifetime of the British and American tests is the more remarkable, because the number of lamps in each group was so small. There were only six lamps in each batch, and two batches contained one lamp that behaved so differently from the rest as to call for expulsion. That is, one American lamp "slumped" and one British lamp "boosted," but these eccentricities of behavior were noticeable almost from the start.

## THE ELECTROSTATIC CAPACITY BETWEEN EQUAL PARALLEL WIRES.

In electrostatics we have ever presented to us the sharp limitations of our quantitative knowledge and mathematical methods. If a pair of conductors, say, a pair of cubical tin biscuit boxes, are supported on insulators at a definite distance apart in air, in a certain geometrical relation to each other, the electrostatic capacity of the condenser formed by the boxes is beyond existing mathematical capabilities to determine, except in the particular case when two faces are opposed squarely at a small intervening distance. But Nature works out the results instantly, and the capacity can always be measured experimentally within the degree of precision permitted by the method and apparatus of the measurement. Nor is it only in electrostatics that the baldness of our mathematical ignorance appears conspicuously when the hat of complacency is lifted in the presence of truth. As a celebrated mathematical optician once remarked, a beam of light takes less than a millionth of a second to select its path through a compound lens of given dimensions and qualities of glass; whereas a skilled mathematician may have to spend a month in computing it.

There are, however, certain simple geometrical forms in condensers for which the electrostatic capacity has been safely computed, and one of these is a pair of equal and parallel cylinders situated in a uniform insulating medium. This case is strictly represented by a pair of straight parallel equal wires *in vacuo*, and is represented with sufficient precision for practical purposes by a pair of equal wires suspended in air at a uniform distance apart, on insulators, from pole cross-arms. The formula for the linear electrostatic capacity of such a system has been known for at least thirty years in its specific application and for half a century in its general application. The strict formula, as originally produced, was somewhat lengthy to compute with, but a short cut, using anti-hyperbolic functions, was first published about a year ago by Blondel. To

simplify the computation, two or three different approximate formulas have been in vogue among electrical engineers. These simpler formulas give results that are entirely satisfactory for engineering purposes when the interaxial distance between the wires is not less than a dozen times the wire diameter. As a general rule, in overhead wire construction the interaxial distance is usually over a hundred times the diameter. In such cases the difference between the results of the strict formula and the approximate formula is microscopic. If, however, the approximate formulas are applied to cases in which the wires are not many diameters apart, serious error may be involved, the amount depending on which particular approximate formula is used.

In the article by Messrs. Harold Pender and H. S. Oosborne which we publish this week the gravity of the error due to forcing one of the approximate formulas down to a ratio of interaxial distance to diameter as low as 1.087 is duly signalized. The inexpediency of whipping a lame horse has long been advertised by moralists. It may, however, be pointed out as some extenuation in the case considered that the lameness of the horse was clearly made evident to all beholders, because the tables of capacity in question cited on their faces the particular formula to which they owed their birth. The article substitutes for the lame approximate formula a shorter and more rigid formula, using the recently developed anti-hyperbolic method. The article also develops in a very interesting way the new and beautiful proposition that the surface density of the charge upon a pair of equal parallel wires is in all cases an ellipse. When the wires are brought close together the ellipse is flat and long drawn out, but when the wires are many diameters apart the ellipse degenerates into a simple circle of uniform charge distribution.

## STATE OR NATIONAL CONSERVATION?

There seems to be a general agreement that our natural resources are in sad need of conservation, but the friends of the conservation policy are apparently becoming divided into two hostile camps, one holding to the idea of national control, the other utterly repudiating it and insisting that the states, and the states only, have a right to deal with the matter. It is the old doctrine of states' rights in another of its innumerable phases. A letter from Mr. Percy H. Thomas in the current issue brings to notice an interesting situation which seems not unlikely to arise at any time and which has an important bearing on the question of responsibility in conservation. The hypothetical case is that of the conflict of hydraulic rights on an interstate stream. Suppose under state authority vested rights had been secured and development had been made near the state border. Next, assume a later development with large storage capacity a short distance upstream, but over the border of the state. It is perfectly clear that the later upstream plant in utilizing its storage could practically cripple the older plant further down, and in the normal course of operations, without any malicious intent, would be very likely to do so. We call to mind several streams in which this situation is very likely to arise. Now, if the hydraulic laws in the respective states happen to be identical, the rights of the parties would be very easily determined, but if they were materially different questions would probably arise which could be solved only with great difficulty, particularly if the stream did not happen to be a navigable one.

Rights of interstate streams have been from time to time before the courts in long-drawn litigation, but there is not yet any body of precedent which seems to be capable of dealing with perfectly possible cases of interference which are very likely to arise. Congress undoubtedly has authority to legislate on the subject under its general interstate authority, even if the stream is not a navigable one; but unless it does so a situation might arise at any time which would be perilously acute, if, following a line of development which is now well marked out, the upstream plant in our supposed case should be owned by the state and leased to an operating company. The private corporation downstream would then find its path through the courts blocked in a conflict with a sovereign state. Such possibilities point strongly toward the federal control in spite of the very natural tendency to depend in such cases on the police powers of the state and local self-government. There are many streams along the Appalachian and Rocky Mountain watersheds which might become involved in the situation that our correspondent considers.

In still other ways, interstate difficulties may be found in the conservation situation from the hydraulic standpoint. It may be necessary or desirable to safeguard the watersheds of one state in order to protect the water-powers of another, a situation in which national control would be effective, while action by the states would probably be very difficult to secure. These facts bear heavily against state control, even supposing that efficient state action in protection of the rights of its own citizens could readily be obtained. There is grave doubt in the minds of many whether state governments as a whole are not more readily influenced by large private interests than is the national government. We could mention several states in which it is generally understood that many bills have to receive the assent of influential railway presidents before they are permitted to become law. Influences so potent as these may be exercised in favor of conservation or they may not; and while powerful influences are constantly at work on Congress, we have faith to believe that their authority seldom or never extends so far as we have just intimated. The interests of all people, irrespective of their residence in any particular state, will be affected by the conservation policy carried on within the boundaries of the United States; and long previous experience in this country with state legislation indicates that where general interests are involved, uniformity of action throughout the territory of the United States is the only means by which effective action can be attained.

Congress has been cautious and properly so in taking important action under its general right to protect the public welfare, but it looks very much as if, in the matter of conservation, a point had been reached when such action would become highly desirable. State control, if prompt and effective is perhaps to be preferred on general principles to national control, since the general theory of our government is based on the preservation to the fullest practicable extent of local rights. Yet in cases of possible or probable conflict between local rights it is the general tendency to harmonize the differences through Congressional action, for which there is ample though somewhat ill-defined authority in the constitution. Certainly in the important issues of conservation that are now under discussion there are so many features involving interstate rights that dependence solely upon state action would appear to be chiefly effective in promoting litigation.

## Additional Single-Phase Equipment for the New York, New Haven & Hartford Railroad.

In the annual report of the Boston & Maine Railroad, just issued, it is stated that plans are being prepared for the electrical equipment of the Hoosac Tunnel. The statement calls renewed attention to the electrification plans of the New York, New Haven & Hartford Railroad because, owing to the control of the Boston & Maine Railroad by the New Haven road, the work of electrification will be conducted by the electrical engineering department of the New York, New Haven & Hartford Railroad Company.

The New York, New Haven & Hartford Railroad has at present in consideration or under way five electrification plans, as follows:

First, the equipment of the Hoosac Tunnel, which is about 25,000 ft. in length and consists of two tracks.

Second, the electrical equipment of the New York, Westchester & Boston Railroad, which extends from 180th Street or Adams Street, in New York, to the corner of East Fulton Street and Columbus Avenue, thence across the present New Haven tracks to North White Plains on the north and New Rochelle on the east. At 180th Street, New York, the road will connect with the present subway, for which it will act as a feeder. This line is twenty-one miles in length and consists of two tracks and four tracks.

The third electrification plan is that of the Harlem River branch from New Rochelle to Morrisania and consists of six tracks.

The fourth is the extension of the present electrified section of the road from Stamford to New Haven, consisting of four tracks.

The fifth is the equipment of the Boston terminal and the electrical zone around Boston.

It will be of great interest to learn that a decision has been reached to use the single-phase system at 11,000 volts on all of these systems, including the Hoosac Tunnel.

The section comprising the Hoosac Tunnel line to be equipped will be from North Adams, which is beyond the west portal, to the immediate vicinity of the east portal. Both freight and passenger trains will be hauled through the tunnel by electric locomotives equipped with motors of the conductively-compensated single-phase type.

The locomotives, of which there will be five, will be somewhat similar to those used on the main branch of the New Haven road. The only difference will be that the direct-current features of the main-line locomotives, required for operation on the New York Central tracks between New York and Woodlawn, will be eliminated; that is, the Hoosac Tunnel locomotives will be "straight single-phase." Energy will be obtained from a station which will be erected by the company. This station will have a rating of 600 kw in two 3000-kw turbine units. An 11,000-volt overhead system will be erected in the tunnel, which has a height of 18 ft. or a clearance of slightly more than 4 ft. above the cars. Work has already been commenced on this installation.

Messrs. Stillwell & Putnam, of New York, have been retained as constructing engineers for the electrical equipment of the Hoosac Tunnel, under the direction of the engineers of the New York, New Haven & Hartford Railroad Company.

The second electrification plan mentioned is that of the New York, Westchester & Boston, which will also be single phase, but the service will be entirely by motor cars. From 75 to 100 cars will be required. The ratio of motor cars and trail cars has not yet been finally determined. This will also be a "straight single-phase" road, without direct-current complications, and 11,000 volts will be used on the trolley. It is interesting to learn that before the adoption of the single-phase system on the New York, Westchester & Boston Railroad the New Haven road secured from Messrs. Stillwell and Putnam a report on the proper system to use. The decision of these engineers was in favor of the single-phase, at 11,000 volts, similar to that used on the main line of the New Haven Railroad.

Authorization to equip the Harlem River branch of the road for 11,000-volt, single-phase operation was made by the directors some time ago.

The extension of the main line electrification from Stamford to New Haven has been authorized by the directors, but will not be undertaken until some of the other work described above is further advanced.

All the engineering work mentioned is under the engineering department of the New Haven railroad, of which Mr. E. H. McHenry is vice-president and Mr. W. S. Murray is electrical engineer.

## The Fort France Electric Power Question.

On the recent visit of Premier Sir Wilfrid Laurier to the Canadian West, the citizens of Fort France took occasion to bring to the attention of the Premier their grievance with respect to the development of power at that point by the Ontario & Minnesota Power Company, known as the Backus interest. It was generally supposed that this question was settled by the action of the Dominion Minister of Inland Revenue, some three months ago, in granting a license to the Backus company for the exportation of power from Canada, but the license is subject to revocation at will by the Dominion government, and, in any event, runs out in March, 1911. In the address presented by the acting Mayor to Sir Wilfrid a plea was made for an equal distribution of power generated at the falls, with a request that the licenses recently granted be revoked on the ground that the company had not lived up to its agreement regarding the price of energy supplied to the users on the Canadian side.

The Ontario & Minnesota Power Company has developed at Fort France 21,000 hp. Of this amount 14,000 hp has been developed from the American side of the river in the form of hydraulic power and 7000 electrical hp has been developed from the Canadian half of the stream. The hydraulic power is being utilized in the grinding of pulp for the extensive paper mills established at International Falls, on the American side, and it is contended that it has been the intention of the company to utilize the electrical power developed on the Canadian side for manufacturing wood pulp into paper. The people of Fort France some time ago took alarm at the prospect of having all the power diverted to the building up of United States industries and made a vigorous fight last winter to induce the Dominion government not to grant the license for the exportation of power which had been applied for by the Ontario & Minnesota Power Company.

The company, however, secured from the Ontario government a statement of its willingness to see 6000 hp exported under certain conditions. The Dominion government, with whom actually rested the right to authorize the export of power, refused to give permission for the exportation of so large an amount of power, but gave a license for the exportation of 3500 hp (being half of the amount developed on the Canadian side), subject to the provision that it was revocable by the Dominion government at will and that, upon demand, prices for the power on the Canadian side of the river must be made which would be acceptable to the Minister of Inland Revenue. The license was only for a limited period and expires next March.

The Dominion statute of 1905 giving the company its rights in Canada provides that half the power generated shall be used in Canada, and the statute of 1907, defining the conditions under which power may be exported, gives the Dominion government the right to fix the Canadian price for power before permitting export to the United States. In granting the temporary license this year the Canadian government did not fix the price.

It is now claimed that no quotation lower than $30 per annual horse-power has been obtainable by either town or individuals from the company for use on the Canadian side of the river. There is also no hydraulic power development on the Canadian

side, so that small industries must rely on electric power, which alone is procurable on the Canadian side.

The town corporation wants the Canadian government either to fix prices immediately for the power retained in Canada or else cancel the contract; also, to take such steps as may be necessary to ensure that upon the termination of the license the original arrangement that half the power generated at this point on the river should be utilized in Canada be enforced.

Sir Wilfrid Laurier, in his reply to the delegation, promised that the rates for Canadian power should be fixed immediately upon his return to Ottawa, and he made the general pledge that before the permanent policy of the government was decided upon the whole matter would be carefully considered with a view to seeing that the people of Fort France obtained fair consideration. On the large question of the exportation of electric power, Sir Wilfrid took the ground that, on general principles, it should never be allowed.

## Electrical Service at the Harvard-Boston Aviation Meet.

Telephone service played a leading part at the recent Harvard-Boston aviation meet in the Squantum district of Quincy, which lasted from Sept. 3 to 15, attracting visitors from many parts of the world. Probably for the first time in the history of the sporting world the entire news report of an event of such international importance was sent out entirely over telephone lines. On account of the decision of the management of the meet to hold the contests and exhibitions at Squantum instead of in the vicinity of the Harvard Stadium there was insufficient time for the installation of telegraph poles and circuits, and emergency measures had to be taken by the New England Telephone & Telegraph Company. The company's plant department at Quincy provided temporary connections between the Dorchester exchange of the Boston district and the aviation field by means of a 30-pair lead-covered cable from the main line to a central point in the rear of the grandstand. From there connections were made to various points about the field, about 2400 ft. of cable being required. The Boston daily papers were provided with direct lines to the press boxes in front of the grandstand, and by this means bulletins were transmitted to the various offices as the events occurred. This service proved to be invaluable in view of the dependence of the various events upon the weather conditions.

For the use of the various officials at the meet exchange service sets were installed in the treasurer's office at the main gate, at the main office in the Administration Building, and in the portion of the field devoted to the parking of automobiles instruments were installed for pay-station service in a tent. Connections were made by underground wires from the cable terminal near the grandstand. At regular intervals in the rear of the grandstand four pay stations were installed and there were also four pay stations in the Administration Building for general public use. Quick connections were maintained between the field and the Blue Hill Observatory in Milton, so that changes in wind velocity and other atmospheric occurrences could be gaged in the shortest possible time before flying began and during the contests. The most striking feature of the service was the provision of a special connection from the field to the Hull Life Saving Station, arranged at the request of Chairman Glidden, of the contest committee, for the purpose of receiving instantaneous reports from Boston Light when the aviators passed out and in in the turn around the lighthouse. These reports followed a wig-wag signal given by the keeper of the light to the life-saving station, the time being taken by chronometer.

The Old Colony Street Railway Company ran a special feeder from Atlantic to the aviation field, and maintained a heavy extra car service on the line. At the close of each day the funds received at the gate were taken to the National Shawmut Bank, Boston, in an electric automobile, and the sparking batteries of the aeroplanes were charged by central-station service.

## Rate Regulation in Indianapolis.

According to the opinion of the city attorney of Indianapolis, Ind., the board of public works of that city has the right to intervene between the Indianapolis Light & Heat Company and consumers and prevent the former from establishing unjust and discriminating rates. While the city's authority is limited in the premises, according to the opinion of the city attorney, "The company has the right to fix its rate to any consumer so long as there is no unjust discrimination, and has a right to classify its rates subject only to the maximum fixed in the contract; but the board of public works has the right to cause it to establish certain rates and then make them public for the information of the general public under the provisions of the franchise. The board only possesses the right to prevent unlawful discrimination by requiring the light and power company to afford an established publicity of its classified rates or giving all of a class the same rate."

The controversy arose when the central station gave a less rate to patrons in districts of the city where competing companies had their lines than to patrons in districts where there was no competition. In a test case the court decided that the board of public works had a right to prevent any discrimination against patrons in districts where no competing lines were established.

## The Montreal Lighting Controversy.

After an adjournment lasting nearly three weeks the arbitrators hearing the case of the Montreal Light, Heat & Power Company against the city of Montreal reconvened in the City Court House on Sept. 13. Immediately, upon the request of the attorneys for the city and with the consent of counsel for the company, the arbitrators adjourned further hearings until Oct. 4 to permit the city's representatives to consider the making of a proposition to the company that if accepted would, without further delay or hearings, permit an amicable settlement of the present lighting controversy. This new situation was doubtless brought about by the opening of bids for city lighting on the day previous.

Some weeks ago the Montreal company formally notified the city that unless some other and more definite arrangement were entered into it would discontinue all street lighting in the city of Montreal proper, where no definite contract price existed, beginning Nov. 1, 1910. The city promptly retaliated by issuing specifications and calling for bids for the exclusive lighting of all the streets of the city of Montreal on flat rates, and municipal buildings and motor demands on meter rates, for a period of ten years beginning Nov. 1, 1910, the number of street lamps specified as at present required being 1650 arc and 500 incandescent, of different candle-power. The specifications are unusually definite and in some points rather unique, as may be noted from the following:

*A Standard Arc Lamp* shall mean a direct-current series luminous arc lamp (magnetite) with an internal concentric reflector with clear globe, consuming not less than 6.6 amp at a voltage of from 75 to 80 at the lamp terminals, and equipped with electrodes of the best quality obtainable.

*A Standard Arc Lamp* shall mean a direct-current series luminous arc lamp (magnetite) with an internal concentric reflector with clear globe, consuming not less than 4 amp at a voltage of from 75 to 80 at the lamp terminals and equipped with electrodes of the best quality obtainable.

*The Standard Illuminating Power of Arc Lamps* shall mean the illumination given by the standard arc lamps described above when measured at a point between 200 ft. and 300 ft. horizontal distance from the lamps, using as a standard of light a fixed calibrated 16-cp incandescent lamp and a standard photometer screen or a standard luminometer.

*Standard Incandescent Lamps* shall be 40-cp and 80-cp (mean spherical) tungsten lamps (series) and shall be equipped with reflectors and brackets approved by the superintendent of the light department.

*The Standard Candle-Power of Incandescent Lamps* shall mean that no incandescent lamp shall be continued in service after its candle-power has declined below 90 per cent of the initial candle-power of that of the standard under which it is installed.

*Tests on Lamps on Service Conditions.*—For the purpose of determining whether the standard illuminating power is being furnished, tests shall be made on lamps under service conditions; such measurements to be made at a point between 200 ft. and 300 ft. distant from the lamp, using as the standard of light an incandescent of 16 cp, calibrated in fixed position, and a standard photometer screen fixed in a horizontal position at a distance of 5 ft. above the level road surface, or a standard luminometer. The result of such tests shall show illuminating power equal to or greater than that obtained by tests for standard illuminating power, as provided for above. In measuring the illuminating power of fluctuating lamps, readings shall be taken of the maximum and minimum illuminating power and the arithmetical mean of the averages of such two sets of readings shall be considered to be the illuminating power of the lamp under test. The mean normal unobstructed illumination at any point nearer the lamp than the test point shall not be less than that determined at such point.

*The Contractor* shall at all times maintain the standard illuminating power during each and every lighting hour during the period of the contract, which may be checked by the superintendent of the light department or his authorized representatives at any time during the continuance of this contract; and the contractor shall furnish the superintendent or his representatives, for the purpose of making such tests of illuminating power, current and voltage, access at all times to all lamps and to the contractor's stations, if required. In order to facilitate the securing of such information as is required by the superintendent the contractor shall install where convenient in his station, on each and every lamp circuit, a curve-drawing wattmeter of approved type, which shall furnish a record of the input in watts to each circuit throughout the hours of operation of each and every day. Such record shall be delivered to the superintendent of the light department each day with the reports provided for below.

*Deductions and Penalties for Part of the Light Stoppage.*—If a lamp or lamps be extinguished or not lighted during a portion of the night exceeding sixty minutes the superintendent of the light department shall deduct from the bills of the contractor half the amount which the contractor would be entitled to receive if such lamp or lamps had been lighted during the whole night; for each and every lamp which shall be extinguished or not lighted for 120 consecutive minutes the superintendent shall deduct the full amount which the contractor would be entitled to receive if such lamp or lamps had been lighted the whole night.

*Deductions and Penalties for Inferior Light.*—The superintendent of the light department shall deduct two nights' pay for every lamp not up to the standard or two nights' pay for each lamp upon a circuit not up to the standard, and three nights' pay for any lamp which the contractor shall fail to light during any night; provided that the superintendent of the light department may, if the circumstances require in fairness that a less deduction be made, remit part of the penalty imposed by this section, subject to approval by the board of commissioners.

*Patrol and Inspection by Contractor.*—The contractor must maintain at his own expense an efficient system of patrol for inspecting lamps during the hours that they should be burning, so that any lamp which fails to burn properly shall be promptly reported and put in order or immediately replaced. It is understood by the contractor that the utmost diligence shall be used in order that the streets, avenues, parks and public places shall be efficiently lighted, and to this end a sufficient number of men shall be employed as inspectors so that each lamp may be examined at least three times per night.

*Daily Reports to Superintendent of the Light Department.*—The contractor shall each day before 3 o'clock p. m. make a written report to the superintendent of the light department stating the number and location of any lamps extinguished or not burning, by whom reported, whether by citizens, police or city's inspectors, giving the time when each lamp was replaced and again started burning, and the said report shall also state the cause for each lamp being extinguished or failing to burn; if any of the said lamps are extinguished by reason of the failure of the current to supply said lamps, or for any other reason, his report shall contain a statement of the cause of such failure to supply current.

*Proof of Fulfilment of Contract.*—It is agreed that on and after the first day of each and every month, during the term of the contract the contractor shall furnish proof to the satisfaction of the superintendent of the light department that he has fully performed and fulfilled this contract and all the particulars and conditions aforesaid, during the preceding month, and particularly that he has operated and maintained the lamps as provided for in these specifications, and that all lamps have been kept clean and in good state during all the time that the lamps were required to be kept lighted. Upon so doing, the superintendent shall certify and in his certificate state the amount to which the contractor shall be entitled for all duties performed in such preceding month; and the account so certified, after being approved by the board of commissioners and the city comptroller, shall be duly paid by the treasurer. Without such proof to the satisfaction of the superintendent he shall not sign any certificate, and without such proof being furnished by the contractor he shall not be or become entitled to any payment in respect to services which were required to be done or should have been done in such preceding month.

The specifications provide for all-night, every-night lighting (4000 hours per year). No bid was to be considered unless accompanied by a certified check equal in amount to 10 per cent of the total amount to be received by the bidder, in case of a contract, during the first two and one-half years of the life of the proposed contract.

When the bids were opened by the board of control at 12:15 noon on Sept. 12 it was found there were five bona-fide bidders, all of whom had complied with the requirements of the specifications in submitting their tenders. The lowest bidder apparently was the Provincial Light, Heat & Power Company, which bid $67.50 for the 6.6-amp and $54.80 for the 4-amp, 1650 arcs, with gradually increasing rates for a less quantity—the specifications permitting the dividing of the total city requirements and awarding parts to separate bidders. The next highest bidder was the Montreal Light, Heat & Power Company, of which the Provincial Light, Heat & Power Company is said to be a subsidiary or controlled company. The Montreal company's bid for 6.6-amp arcs was $72.70 for the total number ranging up to $91.50 for 500 lamps or less, and for the 4-amp lamps was $63.15 and $82.26, respectively. It is claimed that the cost to the city will be practically the same if either the Provincial or Montreal company's bid is accepted, as acceptance of the former company's prices will allow the latter company to continue its present and relatively high-priced contracts with the outlying districts. On the other hand, the specifications provide that any company whose bid is accepted, but which has existing contracts in any part of the city of Montreal, must waive such contracts and accept all city business at the uniform price bid.

This clause, apparently aimed at the Montreal company, explains why that company makes a higher bid than the Provincial company, the figures submitted by both companies "having originated in one mind," according to the newspaper published reports of interviews with Mr. J. S. Norris, the general manager of the Montreal company. The Montreal company's bid for 40-cp and 80-cp tungsten lamps was $16 and $23 per year, respectively, and for lighting the buildings, by meter, 5 cents per kw-hour for all the business, with increasing rates for less proportions. The price for 2200-volt alternating-current power was $25 per unit in units of 150 hp and over.

The new company in Montreal, the Dominion Light, Heat & Power Company, bid for about a quarter of the business at

$85 and $75, respectively, for the 6.6-amp and 4-amp arcs; $10 and $20, respectively, for the 40-cp and 80-cp incandescents and 8 cents per kw-hour by meter. The St. Paul Electric Light & Power Company bid for a small portion of the lighting at $90 and $75 for the arcs and $15 and $25 for the incandescents. The Saraguay Electric & Water Company bid $95 and $78 for the arcs and $27 and $34 for the incandescent. The Canadian Light & Power Company, which is building a 20,000-hp hydro-electric plant on the St. Lawrence River above Montreal with the idea of supplying that city, made no tender for the city lighting, presumably because its plant will not be prepared to deliver anything before the spring of 1911 and the city contract must be taken up Nov. 1 next.

In explanation of the low prices made by the Provincial and Montreal Light, Heat & Power Companies, Mr. J. S. Norris, speaking for both companies, stated that the "disparity between the bids of these companies and the other tenderers, representing from $20 to $30 per arc lamp, is easily accounted for. Apparently the other tenderers have included (and properly so) capital charges on pole and line equipment entailed in the distribution of the arc-lighting service, and having regard to this, their prices would not be too high. Our company, in the estimation of our costs, excluded capital charges on street equipment and to this extent the citizens are the beneficiaries.

"The capital costs entailed in the distribution of the whole of the street-lighting service, as tendered by us, amount to not less than $300,000, the annual interest and depreciation charges on which for the life of the proposed contract must be calculated at 15 per cent at the least; that is, 5 per cent for interest and 10 per cent for depreciation and obviously amount to $45,000, which, divided into 1650 lamps, will give you the saving per lamp conceded to the city in our tender.

"Should the supply of street lighting not be properly charged with this expense? Yes, of course, it is a proper charge, and if circumstances required us to erect poles and lines to supply the street-lighting service we would be obliged to include this expense, but inasmuch as our pole and line equipment is already installed and is used for the supply of our commercial and incandescent service as well, we have eliminated this expense, and, as pointed out, the citizens are the beneficiaries.

"This saving of $15,000 a year," concluded Mr. Norris, "for ten years represents close to half a million dollars, so that it cannot be denied that we have not merely given the city a most liberal proposition, but we have offered to supply the service at a figure which under ordinary circumstances would be considered below cost."

The board of control took the bids under advisement and will make the award later.

## Electrical Exhibits at Pure Food Show.

At the Domestic Science and Pure-Food Exposition being held in Madison Square Garden, New York, Sept. 17-24, there are a number of electrical exhibits in operation demonstrating how closely akin to cleanliness and purity electric heating devices are. The New York Edison Company shows a dining-room and kitchen entirely equipped with electrically heated appliances and a number of ladies, under the supervision of Miss Keinz, are busy preparing delicacies and plain food for consumption at the show. The booth is spotlessly white and prettily outlined with electric flowers. The General Electric Company also has on exhibition a complete line of domestic appliances and has lady demonstrators preparing various articles of food in its kitchen and dining-room. Vacuum cleaners in various sizes are shown by the Duntley Manufacturing Company, of New York and Chicago, whose demonstrators are arrayed in white. The usual models of the Shredded Wheat Company, of Niagara Falls, are on hand turning out "Triscuits" for the edification and nourishment of the crowds, for, as is well known, electricity is employed at the Niagara factory in preparing and baking these biscuits. The United States Navy exhibit includes a huge electric stove from the United States steamship *Dixie* and an electric dough-mixer, potato-peeler and food-mixer. This particular exhibit was the subject of a recent favorable report by a Naval Board, which investigated electric cooking with a view to its adoption on warships.

## Electric Vehicle Advertising Campaign.

The extensive combination advertising campaign originated by the Electric Storage Battery Company for the benefit of the central-station electric-vehicle industry has developed so successfully that it has now been deemed advisable to place its further development in the hands of the newly formed Electric Vehicle Association of America. The Storage Battery Company, as mentioned in a previous issue, has successfully worked up the details and secured the hearty co-operation of electric-vehicle manufacturers and central-station managers, a considerable number of whom have already deposited with the Battery Company their contribution to the advertising fund. The large publicity given to the electric vehicle by this combination scheme should unquestionably result in a great increase in sales of electric vehicles, which means a permanent source of revenue for central-station companies.

## Committee on Schedules in New York.

The committee on gas and electric schedules appointed at the hearing before the New York Public Service Commission for the Second District at Albany on Sept. 7 has effected its organization. Mr. J. C. De Long, Syracuse Lighting Company, is chairman and Mr. Charles H. B. Chapin, secretary of the Empire State Gas & Electric Association, is secretary. The committee has sent a letter to all companies under the jurisdiction of the Second District commission in which it says:

"In the course of its deliberations the committee will probably meet in different parts of the State for the purpose of consulting with the companies in various sections in order to become acquainted with the peculiar conditions under which they are operating. The committee may find it desirable to ask the companies for certain information from time to time. It is hoped that in all matters which may come up the companies will feel entirely free to discuss all of their conditions with the committee, stating any objections they may have to the preparation and filing of schedules of rates, as it is only through the very candid discussion of the matter that a decision can be arrived at which will be absolutely fair to all."

## Cedar Poles and Their Treatment.

At the regular weekly luncheon of the Electric Club, Chicago, Sept. 14, the speaker was Mr. E. L. Clark, president of the Valentine-Clark Company, of Chicago, whose subject was "The Cedar-Pole Industry." A considerable portion of the address and the discussion that followed was devoted to the butt treatment of wooden poles.

Mr. Clark, who was introduced by Vice-president Niesz as the dean of the cedar-pole industry in Chicago, began by complimenting the club as a representative organization of electrical men, many of whom are engaged in active competition in their everyday activities. He gave a brief history of the business of producing wooden poles, and showed how it received a great impetus by the development of the electric light and telephone industries in the '80s. Previous to that time the principal demand for poles had been from telegraph companies. The term "Michigan cedar" is applied to poles obtained from Michigan, Wisconsin and Minnesota, and the poles now obtained are not of so good a grade as those of ten or fifteen years ago. Poles are produced and graded in 5-ft. lengths, and to be merchantable they must be sorted in concentrating yards.

Good Michigan cedar poles are becoming scarcer. Formerly they were largely shipped by water, but now it is probably true that 90 per cent of cedar poles are shipped by rail from the points of production. Western cedar poles are now coming in,

particularly in the case of long poles, which are hard to obtain in Michigan cedar. In the case of Western poles, which are obtained mainly from Idaho and British Columbia, the cost of freight to the Chicago market is a serious item. For instance it costs $4 to bring a 40-ft. Western cedar pole from the nearest available point to Chicago.

Referring to engineers' specifications in the matter of poles, Mr. Clark remarked that these were becoming increasingly strict, particularly in relation to butt, top and intermediate dimensions. He asked the engineers present to remember that poles are produced by nature, and not to ask the impossible. It takes 100 years to produce a 30-ft. pole 7 in. in diameter at the top.

Glancing at the future, the speaker said that in a comparatively few years first-quality Michigan cedar poles will be a thing of the past. It will be necessary to use either steel or concrete poles, or else develop the Western product. Western cedar has not the long life of Michigan cedar, and poles of this wood will have to be butt-treated. In this way the life can be doubled. Pole material is still in existence in the West in large quantities, but the average telephone or electrical engineer seems timid in specifying Western cedar. The Western cedar, however, is much cheaper and it is possible to pay the freight and subject it to an impregnating treatment and still sell it almost as low as the price asked for a Michigan cedar pole of equal size but untreated. Butt treatment, therefore, seems to be indicated as a positive necessity in the future of the cedar-pole industry.

There was a general discussion, and in answer to a question Mr. Clark recommended the open-tank method for the treatment of pole butts. In this method the pole is immersed for from 6 ft. to 8 ft. from the butt in any one of half a dozen first-class compounds, applied hot. The time of impregnation is about eight minutes, and the hot oil is applied at a temperature of about 205 deg. Fahr. By capillary attraction the impregnating compound enters the wood and poisons the food supply of any attacking germ life, so that the pole is measurably preserved from decay.

Mr. E. N. Lake asked about the brush treatment, and Mr. Clark answered that while that was better than nothing, it was necessary to apply the oil hot so that it might be light and penetrate the wood thoroughly.

Mr. H. A. Mott inquired about the practical results of tests, and Mr. Clark in answer mentioned that treated poles had been in the ground in Denver for seven years. No symptoms of dry rot have been exhibited. The oil follows all openings in the wood no matter how minute. The difference between treated and untreated poles in Denver has been marked and entirely in favor of the former.

Mr. James H. Delany asked what compound Mr. Clark recommended for butt treatment, and was told that he favored high-boiling oil or coal tar, or, as it might be otherwise described, the essence of creosote.

Mr. George H. Lukes said that apparently the time is coming when all poles will be concrete or steel. This will be particularly hard for electric-light companies, because it is sometimes necessary for their men to work on the lines when some of the wires are "alive." For that reason the electric-light companies think that all the remaining stock of Michigan cedar timber suitable for poles 30 ft. long or over should be preserved for their exclusive use. This modest request excited some amusement.

Mr. Lake asked when the visible supply would be exhausted, and Mr. Clark said that during the lifetime of men now living it is probable that a certain quantity of smaller poles of Michigan cedar will be available. But the trees are so slow-growing that reforestation is hardly practicable. About the only large supply now existing is in Idaho and British Columbia. Michigan cedar poles are cut as near to the ground as possible, but a different policy is followed with Western cedar. There, if a 40-ft. pole 8 in. in diameter at the top is wanted, the woodman selects a suitable tree, finds out where the trunk is about 8 in. in diameter with the bark off and cuts it down 40 ft. below that spot. This method, which seems wasteful, results in a considerable accompanying production of large saw-logs not available for use as poles.

## Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission gave a hearing on Sept. 16 upon the petition of the Worcester Electric Light Company for authority to issue 2000 additional shares of stock of the par value of $100, the price being fixed by the directors of the company at $180 per share. President George T. Dewey, for the company, stated that the funds to be raised by the issue are to be devoted to improvements in connection with the establishment of a new steam turbine plant at Curtis Pond, in the southern portion of the city. Expansion of business and the necessity of further economies in generation have rendered the old station on Faraday Street inadequate. The general design of the new station, which is now under construction, was recently described in these columns. Mr. Dewey said that additional funds will be required later for the construction of the plant itself, but that the present petition covers the cost of land and improvements in connection with the water supply at Curtis Pond, underground conduit and cable construction between the old and the new stations, and remodeling of the old station to serve as a distributing center. Forty and twenty-duct conduit is to be installed. The southern and easterly portions of the city are to be served directly from the new plant. The cost of the new station will probably be in excess of $500,000.

President Dewey discussed at some length the action of the directors in placing the price of stock to be offered to existing holders at $180 per share. The present dividend rate is 10 per cent on the par value of $100, so that the new shares, if issued at $180, will net a return of about 5.5 per cent. He considered this return entirely reasonable and in fact necessary, in view of the present rates to borrowers of money, which are close to 6 per cent in Worcester. The securities of the Worcester company are largely held at home, and the new investment is a large one for a city of 150,000 inhabitants. If a high price is put on the stock, dividends must be paid in proportion, and the public has to bear the effects of a high price. The city of Worcester charges the full tax rate on the actual money value of the improvements, and in addition the company is obliged to face the prospect of a heavy shrinkage in the value of its old plant, which has been carried on the books for many years. Mr. Dewey said that the situation is much the same as though the company were to begin the business of generating electricity anew. There is no expectation of increasing the dividend, but the high cost of living makes the old returns of 4 and 5 per cent seem too small. Chairman Barker stated that there was much force in the suggestions made with respect to the rate of return on investments, but queried whether the board, in view of its action in placing several 10 per cent stocks at a price of $200 per share, would be justified in allowing the Worcester issue at $180. He added that the volume of securities issued might alter the case. Mr. Dewey closed by stating that the rates on money tend to increase, and emphasized the amount of investment in Worcester which will have to be charged off by the building of the new plant. He said that companies charging off liberal depreciation are apt to be criticised by municipal authorities, and that the assets of the company per share are about $184. General Schaff, of the board, commended the stockholders for retaining their local control of the company a year ago when it was vigorously sought by outside interests. Messrs. M. J. Whittall and J. C. MacInnes, of the board of directors, pointed out the difficulties of paying 10 per cent in the face of such large investments. The hearing was then closed.

In connection with the designation of Prof. George F. Swain as expert in charge of the validation to be made by the State of Massachusetts of the property of the New York, New Haven & Hartford Railroad Company, Mayor Fitzgerald, of

Boston, has issued a statement expressing his regrets that Professor Swain's attention will be diverted for a considerable period from the urban transportation problems at Boston which are before the Railroad and Boston Transit Commissions. Mayor Fitzgerald contends that additional transportation facilities are needed between the city proper and the South Boston, Dorchester and Brighton districts, and that the members of these commissions ought to devote the maximum possible time to the consideration of such problems. Professor Swain is a member of the Transit Commission and is consulting engineer of the Railroad Commission, and the validation which he will make of the New Haven property will be one of the most comprehensive in the history of American transportation.

The Railroad Commission has granted the Boston & Northern Street Railway Company the right to carry freight in the town of Chelmsford.

The Boston Consolidated Gas Company and the East Boston Gas Company have petitioned the Gas and Electric Light Commission for approval of a contract which they have entered into, under which the East Boston company is to purchase gas from the Boston company for a three-year period beginning Dec. 1, 1910. The gas is to be sold at the rate of 40 cents per 1000 cu. ft., plus $3,500 a year for the use of mains in Chelsea. A public hearing will be given by the board.

The Massachusetts Railroad Commission gave a hearing on Sept. 14 upon the petition of the Selectmen of Lenox for the establishment of a 5-cent fare on the lines of the Berkshire Street Railway Company within the town. Mr. Bentley W. Warren, of Boston, counsel for the company, stated that the present through fare between Lenox and the city of Pittsfield is 15 cents, and that if the petition were granted it would be reduced to 10 cents. He stated that the company appreciated what the people of Lenox had done for it, but that it was not correct to compare facilities in Pittsfield, a rapidly growing city, with those which could be afforded in a small town like Lenox, which has a summer population of 6000 and a winter population only half as great. A 10-cent rate from Lenox to Pittsfield would give the company a return of only 1 cent per passenger-mile, which cannot be sustained under present conditions. In the larger cities where such a rate obtains the average ride is shorter. Great density of traffic is needed to make a rate of 1 cent per mile pay. The company is willing to concede a 5-cent fare, including a transfer, from the center of Lenox to New Lenox, but it cannot afford to reduce the fare to 10 cents from Lenox to Pittsfield. The board took the case under advisement.

## Canadian Hydroelectric Commission News.

At a public meeting held at Guelph, Ontario, Canada, on Sept. 13 to discuss the People's Railway project, Hon. Adam Beck, chairman of the Hydroelectric Commission, expressed the opinion that when the transmission line of the commsision from Niagara Falls to the western Ontario municipalities was supplying energy the municipalities would pay for the energy on the basis of the amount actually used and not on the amount contracted for. He hoped that in a couple of years the commission would be able to achieve this result.

On Sept. 13 the city of Berlin was illuminated with electricity conveyed over the commission's line from Niagara Falls, being the first of the cities within the union to be supplied with Niagara energy. The energy is transmitted at 110,000 volts, being stepped-down to 13,200 at the transformer station at Berlin and retransformed into 550 volts for street-railway purposes and 500 volts for operating the corporation's arc lamps lighting the streets. The illumination was in the nature of a test of the line and lasted for an hour and a half with signal success.

Hon. Mr. Beck stated at the meeting in Guelph that as a result of the saving on the price of the equipment furnished the commission, the price to be charged for energy in Guelph will be $21.79 per horse-power per year instead of $24. The equipment was supplied for $307,000 less than the estimates.

## New York Commission News.

The Public Service Commission, Second District, has authorized the Southern New York Power Company to issue $24,000 of its capital stock at par in payment of all the property, assets and franchises of the former Walton Electric Light Company, of Walton, N. Y., and $2,100 in payment of all the property, assets and franchises of the Mulkins Electric Light Plant, also situated at Walton. The company in its application asked for permission to issue $40,000 common capital stock, par value $100 a share, to purchase franchises and property of Walton Electric Light Company.

The Red Hook Light & Power Company, of Red Hook, Dutchess County, has been authorized to take over franchises from Mr. John H. Sharp in the towns of Germantown, Livingston and Clermont, Columbia County, and also to exercise the rights and privileges under these franchises. The company is also authorized to execute a first mortgage upon all its property, assets and franchises to secure the payment of $150,000 in bonds, payable in fifty years, bearing interest at 5 per cent. The company is authorized at the present time to issue $10,000 of its bonds at not less than par in exchange for $10,000 first mortgage 5 per cent bonds now outstanding on the property of the corporation; also $60,000 of bonds to be sold at not less than 80 to pay for indebtedness incurred in the construction of new lines and equipment.

The Municipal Gas Company, of Albany, has been authorized to exercise franchises granted by the town of Bethlehem for furnishing electricity upon and along the Albany and Greene Turnpike and upon and along all public roads and highways intersecting said Albany and Greene Turnpike in the town of Bethlehem, Albany County.

The Public Service Commission, Second District, has appointed Mr. Walter I. Sweet, of Port Richmond, Borough of Richmond, New York, to be assistant chief of the division of telephones and telegraphs at a salary of $3,000 per year, to be in charge of the New York office. Mr. Sweet is 45 years of age and has had extensive experience in telegraph, railroad and telephone service. In 1906 he was district manager of the Jersey City district of the New York & New Jersey Telephone Company and two years later upon the merger of the functional and territorial organization with the New York Telephone Company became local agent in charge of the commercial department of the company and was the senior officer of the company in that district.

Mr. William G. McAdoo, president of the Hudson & Manhattan Railroad Company, sent a proposition to the Public Service Commission of the First District for the construction and operation of a subway line connecting the Thirty-third Street station of his system with the Hudson Terminal station at Cortlandt Street. It is suggested that this line be laid out under Broadway from Thirty-third Street to Fourteenth Street, thence under University Place, Wooster and Church Streets to the Terminal buildings. It is proposed that the line be constructed on the city's credit and leased upon terms similar to those of the present subway. Mr. McAdoo also intimated in his letter that his company might become a bidder for the construction and operation of the proposed Broadway-Lexington Avenue subway.

Commissioner Bassett announced last week that if the Interborough Rapid Transit Company could not make any satisfactory arrangements to build a line down Seventh Avenue from Forty-second Street south to the Battery, the Pennsylvania Railroad would submit a proposition to build a subway of its own from the City Hall to Times Square, connecting with its new station.

The Public Service Commission, Second District, will dusing the present week hear the complaint of Mr. John Snyder, of Albany, against the Municipal Gas Company of that city as to charge for electric energy. The application of the Poughkeepsie Light, Heat & Power Company, the Newburgh Light, Heat & Power Company and the Hudson Counties Gas & Electric Company for leave to consolidate will also be heard.

## Wisconsin Commission News.

The Railroad Commission has devised a schedule of rates for electric service for the municipal plant of Jefferson. The investigation was carried out because the present rate schedule appeared to be unsatisfactory to municipality and consumer alike.

The electric plant was found to have cost new about $59,721 and has a present value of about $50,815. The total operating expense amounts to $8,629 when depreciation is computed at 4.5 per cent and interest at the rate of 3.5 per cent. The total amount is $9,227 on the basis of 4.5 per cent interest.

The gross earnings of the plant for the year ended June 3, 1910, were $8,741, of which the earnings from public service or street lighting were $1,590; from commercial consumers, $6,971, and from rent of building $180. This total amount slightly exceeds the amount of operating expenses when such expenses include interest at 3.5 per cent, but falls short when a higher rate of interest is used.

The present rates are based upon consumption only and do not recognize the question of demand.

From an analysis of the operating expenses the apportionment (excluding the consumption expenses) into capacity and output expenses for both commercial and street lighting is as follows:

| | Capacity | Output | Total |
|---|---|---|---|
| Commercial lighting | $3,320.36 | $2,745.75 | $6,066.11 |
| Street lighting | 664.23 | 1.406.64 | 2,070.87 |
| | $3,984.59 | $4,152.39 | $8,136.98 |
| Consumption | 492.85 | | 492.85 |
| | $4,477.44 | | $8.629.83 |

Of the total capacity cost $664.23 is chargeable against the street lighting service and $3,320.36 plus $492.85 or $3,823.21 is the commercial lighting charge. This is on the basis of 3.5 per cent interest, which seems the most reasonable under the circumstances.

Under the present rates the street lighting department receives but $1,590 annually for the 106 32-cp lamps operating on a moonlight all-night schedule. This amount is less than the total cost of operating them.

An analysis of the earnings and operating expenses shows that while a reduction in rates might be offered, the rates should be so readjusted as to distribute more equitably the burden of expense and that the charge for street lighting should be increased in order that this branch of the service shall have its just share of the total cost of operation.

The total consumption during the year by the commercial lamps was 51,745 kw-hours. Prorating the output expense, $2,745.75, over this consumption, gives an output cost per kw-hour of 5.3063 cents.

The total connected commercial lighting load is approximately 160 kw. With 50 per cent active the capacity expense per kilowatt of active connected load is $3,813.21/80 = 47.66. If the plant is operated for only one hour per day the capacity expense per kw-hour is $47.66 divided by 365, or 13.58 cents. The table of unit costs computed as above is as follows:

| Capacity | | Output | Total | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 26.116 | plus | 5.3036 | =31.42 | cents | for | ½ | hour | operation | daily |
| 13.058 | " | " | =18.36 | " | " | 1 | " | " | " |
| 6.529 | " | " | =11.84 | " | " | 2 | hours | " | " |
| 2 611 | " | " | = 7.92 | " | " | 5 | " | " | " |

From an analysis of the consumer data and of conditions existing in the city of Jefferson, together with the results obtained above, it appears that a primary rate of 16 cents per kw-hour for the first sixty hours' use per month of the active connected load and a secondary rate of 10 cents per kw-hour for all current used in excess would best meet the situation. A discount of 10 per cent for prompt payment can be offered.

In Class A, consisting of residences, rooming houses and public buildings 40 per cent of the total connected load is to be considered active. In Class B, consisting of schools, churches and industrial establishments closing not later than 6 p. m., 60 per cent is to be considered active. In Class C, consisting of stores, offices, livery stables, hotels, saloons, banks, etc., 75 per cent is to be considered active.

The rate for all 32-cp incandescent lamps operating on a moonlight all-night schedule is increased to $18 per lamp per year.

The commission recommends that all meter rentals be abolished and that a uniform minimum bill of 50 cents be charged all consumers.

The Sheboygan Railway & Electric Company has been authorized to issue $600,000 of 5 per cent gold coupon refunding and improvement bonds. These are to be issued in denominations of $500 and $1,000 each and the total issue is to be secured by a mortgage and trust deed executed to the Wisconsin Trust Company, of Milwaukee. Of the total $440,000 is to be used for retiring or refunding an outstanding bond issue to the amount of $400,000 and $160,000 for the purpose of paying an outstanding floating indebtedness. The balance is to be used for the erection of new car barns and the purchase of additional rolling stock, machinery, etc. The bonds are to be sold for not less than 75 per cent of the par value.

The North Milwaukee Light & Power Company has been authorized to issue 500 shares of common stock of the par value of $500 each. The funds derived from the sale are to be used in paying an outstanding indebtedness incurred by reason of additions to property and also to provide for extensions in the future.

## Maryland Commission News.

Richard B. Fentress, of the Baltimore Electric Light & Power Company, announced last week that all opposition to the development of the Fentress-Mediary lighting franchise had been withdrawn and that he would soon be prepared to deliver electrical energy to consumers in Baltimore and thus introduce competition in that field. Mr. Fentress' announcement came after an order had been filed in the United States Circuit Court dismissing his bill of complaint against John M. Van Dyke, supposed to represent Standard Oil interests, who owned one-half of the franchise and who was understood to be opposed to the development of its business. According to Mr. Fentress' statement, there is now no obstacle in the way of the development of the franchise, and he says that he is prepared to spend $2,500,000 for erecting a suitable plant and distributing the power. The Public Service Commission has unofficially announced that before these plans can be carried out it will be necessary to have them approved by the commission. Under the Fentress-Mediary ordinance the city gave a franchise right for a company to compete in the electric lighting field with the Consolidated. In view of the existence of this ordinance there was speculation as to whether or not the Fentress interests could start in without supervision.

## AMERICAN ELECTRICAL ENGINEERS—XIV.

### Otto E. Osthoff.

Otto Ernest Osthoff was born in Cleveland, Ohio, October 4, 1874. At the age of six years his parents removed to the town of Delphos, Ohio, where he received a common and high school education. At the age of sixteen he entered Adelbert College of Western Reserve University, Cleveland, Ohio, and pursued classical studies for a period of three years, and then went to the Case School of Applied Science, Cleveland, Ohio, where he completed an advanced course in physics and mathematics, graduating in 1896 with the degree of B. S. In addition to the regular course, studies were incidentally pursued in mechanical, electrical and hydraulic engineering. Mr. Osthoff's graduating thesis was based on a research having for subject the relative coefficient of expansion of hydrogen as com-

pared with oxygen, the work having been done under the guidance of Dr. Miller, professor of physics in the Case School of Applied Science, and Dr. Morley, of Adelbert College. While at the university he gained the Reid prize in physics, given annually by Dr. Reid, of Johns Hopkins University, to the student passing the best special examination in physics, and also obtained the highest average grade in all studies in the sophomore year. Mr. Osthoff served as editor-in-chief of the college annual, *The Differential*, and was also instructor in physics for one year while following regular studies.

After graduation in 1896 Mr. Osthoff entered the employ of the Willard Storage Battery Company, of Cleveland. During his first year's connection with this company he pursued post-graduate studies and in 1897 received from the Case School of Applied Science the degree of E. E., the subject of the post-graduate thesis being "The Design of Central Station Storage Batteries." He remained with the Willard Company for several years, assisting in the development of its storage battery plates, etc., and in 1900 entered the employ of the Electric Storage Battery Company, of Philadelphia, in its construction department. He remained in this department for a year, doing considerable work in New York City and Brooklyn, and then went to Chicago as western engineer of the company at its Chicago office.

O. E. Osthoff.

In 1902 Mr. Osthoff became associated with Mr. H. M. Byllesby, of Chicago and upon the organization of H. M. Byllesby & Company was made a vice-president, director and the chief engineer of that company. He has been identified with H. M. Byllesby & Company ever since, having direct charge of the engineering department, which embraces all engineering pertaining to steam, electricity, water-powers, water works, etc., and is also concerned, as an officer and director, in the development of the general policies of the company. In addition, he is vice-president and director of the Interstate Light & Power Company, Galena, Ill.; vice-president and director of the Northern Idaho & Montana Power Company; director of the Tacoma (Wash.) Gas Company; director of the Fort Smith (Ark.) Light & Traction Company; director of the Bitter Root Mountain Water Company, and an official and director of the Chicago Securities Corporation.

Representing H. M. Byllesby & Company, Mr. Osthoff has acted in the capacity of consulting engineer for the city of Duluth, having had general charge of the recent large extensions there of the water works and municipal gas plant, and designed and constructed the new artificial gas works for the United States Steel Corporation in the new town of Gary, Ind. He has had general supervision of the design and construction of the water power electrical plants built at Sioux Falls, S. D.; Mankato and Cannon Falls, Minn.; Somerset, Wis.; Big Fork, Mont., and several others still in the stage of preliminary design. He has also had general charge of the design and construction of the new steam plants at San Diego, Cal.; Oklahoma City, and Muskogee, Okla.; Mobile, Ala.; Fort Smith, Ark.; Ottumwa, Ia., and some half-dozen steam plants recently constructed for the Northern States Power Company, operating in Minnesota, including the city of St. Paul; also steam plants for Oshkosh, Wis., for the Interstate Light & Power Company, Galena, Ill., and Platteville, Wis., and three steam plants for the Northern Idaho & Montana Power Company operating in the states of Montana, Idaho, Oregon and Washington. Mr. Osthoff has also had general supervision of the design and construction of the crude oil gas works at San Diego, Cal.; water and coal gas plants at Oklahoma City, Muskogee and Enid, Okla.; five coal and water gas plants controlled by the Northern States Power ompany; and new gas works at Tacoma and Everett, Wash.; Springfield, Ore., and Oshkosh, Wis.

Mr. Osthoff is an associate member of the American Institute of Electrical Engineers, and member of the Western Society of Engineers, American Water Works Association, American Gas Institute, National District Heating Association, American Academy of Political and Social Science, American Civic Alliance and American Association for the Advancement of Science. He is also a member of the Union League Club of Chicago, University Club of Chicago, Lawyers' Club of New York City, Arlington Club of Portland, Ore., and of the Greek letter scientific society, Sigma Xi.

## CURRENT NEWS AND NOTES.

**Railway Electrical Engineers.**—As previously announced, the annual convention of the Association of Railway Electrical Engineers will be held at the Hotel La Salle, Chicago, on Sept. 27 to 30 inclusive. The association is composed of the electrical engineers and chief electricians of steam railroad companies, and a good program has been prepared. Incidentally there will be an exhibit of electrical appliances for the benefit of the railroad men. Mr. W. E. Ballentine, of the Willard Storage Battery Company, 320 Dearborn Street, Chicago, is in charge of the exhibits.

**Explosion in Boston Elevated Power Plant.**—An unusual accident occurred in the Harvard power station of the Boston Elevated Railway Company in the early morning of Sept. 16 in the form of an explosion of the intermediate receiver of a vertical cross-compound engine driving a 2700-kw direct-connected railway generator. The accident occurred at the time when the morning load was coming upon the station and the engine platform was demolished, with some damage to the station building and roof. The watch engineer in charge of the plant at the time was severely injured. Service from the plant was quickly resumed.

**New York I. E. S. Meeting.**—At the first regular meeting of the season 1910-1911 of the New York Section of the Illuminating Engineering Society, which will be held Oct. 13, the subject of "Street Lighting" will be discussed. Mr. Preston S. Millar will present a paper on this subject, which will be illustrated by miniature street models and lighting equipments. Mr. V. R. Lansingh will give an informal talk on a new Holophane street-lighting unit, which will be illustrated by lantern slides showing installation and illumination data. It is expected that the subject of street lighting will be thoroughly treated in the general discussion.

**No Oklahoma Convention This Year.**—It had been planned to hold a meeting of the Oklahoma Public Utilities Association in Oklahoma City on Sept. 30 and Oct. 1. It has been decided, however, to abandon this proposed meeting, and there will be no convention of this association until next year.

**Low-Priced Meter.**—According to the *Bulletin* of the National Electric Light Association, one of the electrical manufacturing companies is making rapid progress on a low-priced alternating-current meter—presumably a watt-hour meter—which will be placed on the market within the next six months.

**Colorado Electric Club.**—At the weekly luncheon of the Colorado Electric Club on Sept. 8 a talk was given by Senator Charles Hughes, of Colorado, on the development of electrical industries in the State during the past decade. At the luncheon on Sept. 15 Mr. Joseph Tuttle, past-president of the Sons of the American Revolution, gave a talk on the early history of Colorado and the contest of the powerful Hudson Bay Company for the territory including it.

**Murray Printing Telegraph.**—In order to extend knowledge of the Murray printing telegraph systems, the inventor, Mr. Donald Murray, Midway Park Works, London, England, has begun the issue of *The Murray Printing Telegraph Journal,* which will be published at irregular intervals two or three times a year. In addition to giving information as to the progress of the Murray system, now used in the British telegraph service, practical articles will be printed on the adjustment and maintenance of Murray apparatus and on the principles of printing telegraphy in general.

**Gas Company Advocating "Amber" Light.**—The People's Gas Light & Coke Company, of Chicago, is attracting some attention by extensive advertising of "Amber Light—A New Discovery." The "new discovery" is a Welsbach mantle that does not give a greenish glare. A house-to-house campaign to demonstrate the advantages and possibilities of the "new" light is announced. Fixtures, including shade, mantle, burner and chain-pull ignition, are sold at $1.60 each. The color of the light is due to the chemical constituency of the mantle, giving the yellowish shade advertised as "amber."

**Smoke Nuisance in St. Louis.**—The smoke inspector of St. Louis promises an active campaign to abate the smoke nuisance in that city. The Business Men's League and other commercial organizations have pledged their support. In carrying out his work, Mr. Parker, the smoke inspector, has procured photographs of the smoking chimneys of a number of industrial power plants and some of these have been reproduced in the daily papers. By an interesting coincidence one of these pictures is given directly under an "ad" of the Union Electric Light & Power Company pointing out the advantages of central-station power service. Of course, the substitution of central-station service for small isolated power plants would have a marked effect in reducing the production of smoke.

**New York State Water-Powers.**—In a recent report of the New York Water Supply Commission it is estimated that, neglecting the Niagara and St. Lawrence rivers as international streams, the total water-power of New York State is 1,500,000 hp, of which 620,000 hp is in use and 880,000 hp is undeveloped. It is further estimated that the State could obtain an annual profit of $1,400 000 by developing the unused water-powers, the estimate being based on an annual rental value of $5 per annual horse-power. Moreover, an additional population of 1,000,000 would be supported by the utilization of the water-power. The commission recommends that the State should authorize the issue of $20,000,000 to develop the water-power now going to waste on the basis of repayment from future profits.

**Germans Attack Patent Agreement**—The Association of West German Manufacturers at a recent meeting adopted resolutions calling on the government to give notice to the United States of the termination of the patent agreement made Feb. 23, 1909, on the ground that it is detrimental to the interests of German inventors, patent owners and German industries generally. Failing this a revised patent law, which shall deprive Americans of certain privileges they now enjoy under the international agreement, is asked. One of the charges made in support of the protest against the patent agreement is that some American manufacturers purchase German patents solely in order to keep out the German-made inventions covered, at the same time suppressing their manufacture in this country.

**McCall Ferry Electric Power for Baltimore.**—Superintendent McCuen of the Department of Lamps and Lighting of Baltimore has received a letter from the Pennsylvania Water & Power Company stating that the company will be unable to supply the city of Baltimore with electric current. The city had been considering the purchase of electrical energy at a low rate from the company, which is developing the water power at McCall's Ferry. The Pennsylvania company stated that it had already disposed by contract of all the energy it will be able to supply in Baltimore, presumably to the Consolidated Gas, Electric Light & Power Company. The Baltimore County Commissioners have decided to grant the Susquehanna Transmission Company of Maryland permission to cross certain public roads in the Eleventh and Fourteenth districts with its electric wires. The company will convey electric power from McCall's Ferry to Baltimore. The transmission line is being rapidly pushed to completion.

**Kansas Electrical Convention.**—In addition to the papers appearing on the preliminary program of the thirteenth general meeting of the Kansas Gas, Water, Electric Light & Street Railway Association, as printed in our issue for Aug. 25, page 420, the following papers will be presented: *The Heating Values of Kansas Crude Oils, Fuel Oil Residues and Distilled Oils,* by Prof. P. F. Walker, Lawrence; *Central Station Methods of Securing New Business,* by Mr. J. D. A. Cross, Chicago; *Comparative Cost of Oil and Coal,* by Mr. W. E. Sweezey, Junction City; *Transformers,* by Mr. E. L. Buchanan, Chicago; *Rates (Water Works),* by Mr. J. H. Rathert, Junction City; *Value of Pure Water,* by Mr. R. E. McDonnell, Kansas City, Mo.; *The Cost of Electric Light,* by Mr. J. T. Skinner, Lawrence; *Holophane Illumination,* by Mr. T. C. Hawkins; *How to Get Motor Business,* by Mr. W. R. Murrow, Independence, and *The Advantage of a Sales Department,* by Mr. J. B. Kennedy, Wichita. The meetings will be held in the Mercantile Club Rooms, Kansas City, Sept. 27 and 28. Mr. M. T. Flyn, of Kansas City, is the president and Mr. James D. Nicholson, of Newton, is the secretary.

**Denver Electric Show.**—Among the features of the Denver Electric Show next month will be a 150,000-volt transformer in connection with a high-frequency coil capable of a voltage of several million with enormously high frequency and giving a discharge in the air of upward of four feet. This will be used with various pieces of apparatus to demonstrate high-frequency phenomena, such as lighting electric lamps through the body, lightning effects, lighting of vacuum tubes, etc. Wireless telegraph and telephone sets, X-ray apparatus and the telautograph will be exhibited, Thomson electromagnetic phenomena demonstrated and an electric water forge operated. There will also be an electric welding machine in which a bar of iron 2 in. in diameter will be welded. During the show there will be a rejuvenation of the Sons of Jove, which will take place on Oct. 11. One of the important sections will pertain to mining, in which will be shown electrically operated every machine used in that industry. Electric pumping in irrigation will be made a feature, both as to exhibits and through the presence of experts to instruct visitors interested in the advantages and economy of the electric motor for this purpose.

## TURBINE STATION OF THE BISBEE IMPROVEMENT COMPANY.

### Interesting Results Obtained in the Operation of a Small Arizona Oil-Burning Plant, with Details of Losses and Their Distribution.

By I. A. Rosok.

BISBEE, Ariz., is a copper-mining town with about 18,000 inhabitants, situated in the southeastern part of the State. Five years ago there was not a steam turbine in operation and but little electricity was used in either mines or town. To-day there are three turbine plants in operation. The Calumet & Arizona Mining Company's plant has three Westinghouse turbo-generators installed. These are rated at 1000 kw, 500 kw and 300 kw, respectively. The Copper Queen Consolidated Mining Company's new plant has three Curtis vertical turbo-generators installed. These are each of 500 kw capacity. The Bisbee Improvement Company's plant has one Allis-Chalmers 500-kw and one Westinghouse 300-kw turbo-generator installed. The latter plant, being the one which supplies electricity to the city, is the one described in this article.

The power plant is located about a mile from the town proper, and the structure, which is built of pressed brick, is 140 ft. long by 41 ft. wide, and contains both the electric generating and the ice-manufacturing machinery. Crude oil is used exclusively for fuel. Nearly all of this is supplied from Texas. The specific gravity of this oil is 0.89 or 28 deg. Beaumé hydrometer. The heating value of the oil is about 19,300 lb.-Fahr. units with moisture and sediments of a little more than ½ per cent. The oil is delivered in tank cars, from which it is run by gravity into the company's tanks. From these tanks it is pumped by an electrically-driven, triplex pump to the oil heater, which is made like a feed-water heater, with the exhaust steam going through it. From this it goes direct to the oil burners. New patented oil burners have been installed recently. These burners, which have been found to use 2.2 per cent of the steam generated for vaporizing the oil, are much superior to the burners formerly used, which required over 4 per cent of the steam generated. The new burner also gives a much better distributed flame and the combustion of the vaporized oil is so complete that smoke is seldom seen to issue from the stacks.

At the present time four boilers are installed in the boiler room. Two of these are water-tube safety boilers of the Stirling type, one of 407 hp and the other of 295 hp capacity. The other two boilers are of the old horizontal, return-tubular type, and each boiler is rated at 125 hp. Space is provided in the boiler room for one more Stirling boiler of 400 hp rating. The Stirling boilers are used regularly and the horizontal tubular boilers are held in reserve. Each boiler has its own smokestack. The mean temperature in these stacks is about 400 deg. Fahr., the draught being about 0.45 in. of water column with dampers nearly closed. The boiler feed water consists of the cooling water from the surface condensers. This water has a temperature of about 100 deg. Fahr., and after being automatically weighed it is passed through a feed-water heater which raises its temperature to about 170 deg. Fahr., and it is then delivered to the boilers. There is considerable lime in the water, and for the prevention of boiler scale a boiler compound has been used with fair success. Steam at a pressure of 150 lb. per square inch is delivered to the turbines and ammonia compressor Corliss engine. The quality of this steam as measured by a throttling calorimeter is about 98.75 per cent dry.

The generating units are of the revolving-field type operating at 3600 r.p.m. and generating two-phase, 2300-volt, 60-cycle alternating current. The generator fields are excited by two motor-driven exciters, and one small Curtis steam-turbine-driven exciter is held in reserve in case of complete shutdown. Only one of the generators is usually run at a time, the other being held in reserve, thus insuring an uninterrupted service. The steam turbines are an improvement over the reciprocating engines formerly used in greater reliability of service, one of the steam turbines having run nearly a year without stopping.

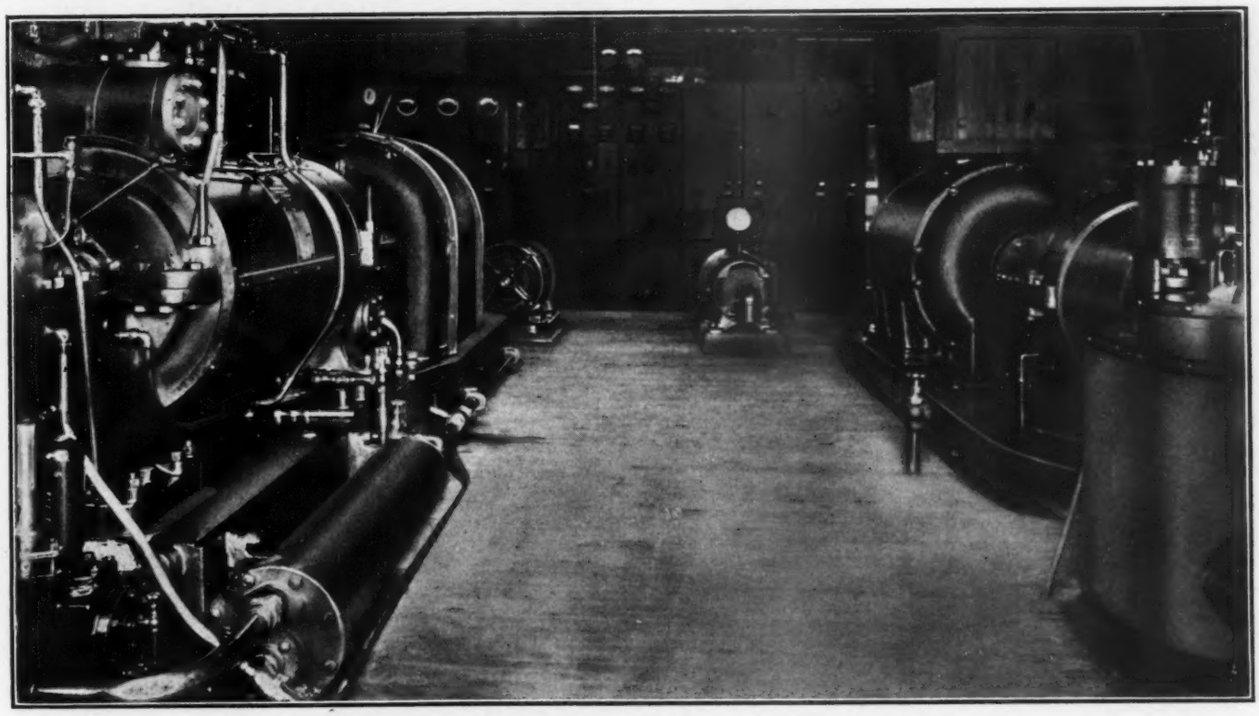


Fig. 1—Turbo-Generators in Bisbee Improvement Company's Plant, Bisbee, Ariz.

The two turbine units now used also require only as much floor space as one of the reciprocating-engine units formerly used.

The switchboard, of nine black enameled slate panels, is equipped with a synchronizer, a frequency indicator, an automatic Tirrill voltage regulator, automatic overload-release oil switches and all standard indicating and recording instruments usually found in installations. Choke coils and two sets of lightning arresters are connected to the outgoing lines to protect the switchboard instruments and generators against the violent lightning storms so frequent during the latter part of the summer.

Two surface condensers of the Alberger type are used for the steam turbines, the one for the 500-kw unit having 1600 sq. ft. of surface and the one for the 300-kw unit 1000 sq. ft. of condensing surface. The condensers are supplied with cooling water from a brush-type cooling tower by motor-driven centrifugal pumps. The dry-vacuum pumps and the hot-well pumps are steam driven, the exhaust steam from these pumps, together with that from the feed-water pump,

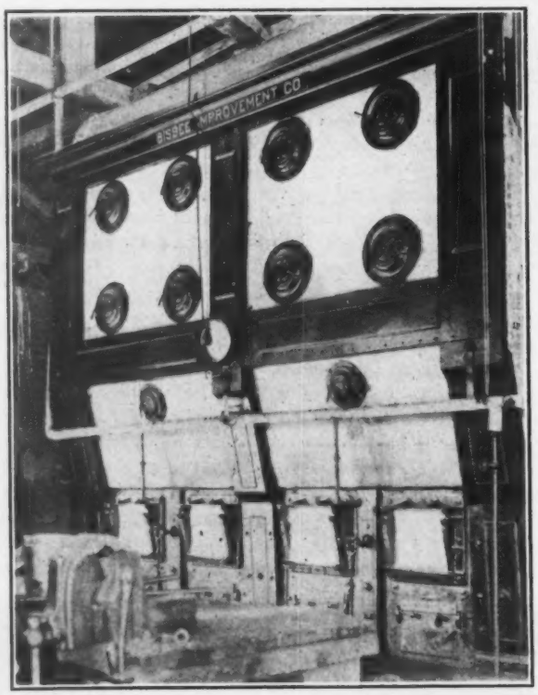



Fig. 2—View of 407-H.P. Boiler.

being passed to the feed-water heater. The condensation from the steam turbines, being free from oil and other impurities, is used for ice-manufacturing purposes. A 1300-sq. ft. surface condenser of the Wheeler type is used with the ammonia compressor engine. The pumps for this condenser are all steam-driven and run condensing.

All the steam pumps in the power house, including those in the ice-manufacturing department, were tested recently for steam consumption. This was done by connecting a small home-made surface condenser to each pump to be tested and weighing the condensed steam on a platform scale. Most of the pumps used such an excessive amount of steam for the work done that it has been decided to replace them with electrically-driven triplex pumps.

The turbines were tested recently for steam consumption and the results of these tests are given below in tabulated form and also by curves. The 300-kw turbine is new, having been in service only a few days before these tests were taken. The 500-kw turbine has been in service about 2½ years. In the turbine guarantee the manufacturers specified a 27-in. vacuum referred to a 30-in. barometer, and as the barometer at this altitude at the time the tests were taken measured only 25 in. of mercury, the steam consumption in the tests was correct to the equivalent steam consumption at 22 in. vacuum. These corrections were made from curves furnished by the turbine manufacturers. The vacuum was in all cases measured by a mercury column. The quality of the steam used by the turbines was measured once during each test by a throttling calorimeter.

The exhaust from the turbines was pumped from the surface condensers into tanks of known capacity, and the weight of this was figured with reference to its temperature. The leakage of the turbine water seals and the condenser leakage were measured for each test and deducted from the weight of exhaust water in the tanks. The volume of cooling water was measured by placing a weir in the water trough before it enters the cooling tower, and these measurements were checked by calculations from the rise in temperature of the cooling water from inlet end to discharge end of the condenser. The switchboard instruments were tested and corrected before the tests were taken. The exciter unit being driven electrically from the turbine under test, by energy registered on the switchboard instruments, it was thought proper to deduct the excitation energy from the average indicated load. The duration of each test was one hour.

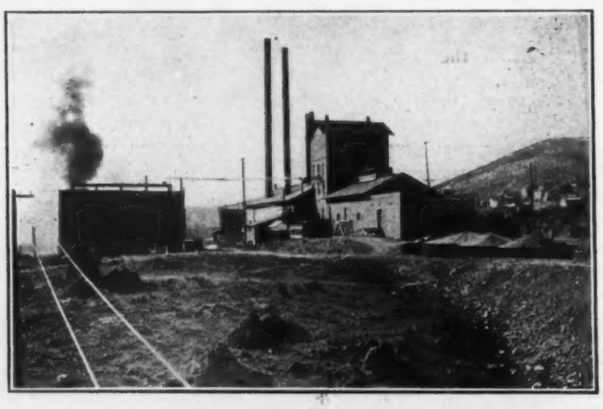


Fig. 3—Cooling Tower, Oil Tanks and Transmission Lines.

An accurate record is being kept of the boiler room, and the amount of feed water, fuel oil and water blown off from the boiler is reported daily. The blow-off water is calculated from

TABLE I.—TESTS OF 300-KW STEAM TURBINE.

| | Test 1. | Test 2. | Test 3. | Test 4. | Test 5. | Test 6. |
|---|---|---|---|---|---|---|
| Average r.p.m. of turbine | 3660 | 3660 | 3660 | 3660 | 3630 | 3620 |
| Ave. steam pres. throttle | 138 | 137 | 138 | 133 | 135 | 136 |
| Quality of steam—% dry | 98.62 | 98.62 | 98.62 | 98.62 | 98.62 | 98.62 |
| Ave. temp. cool. water in | 72 | 71 | 79 | 75 | 81 | 81 |
| " " " " out | 84 | 84 | 96 | 96 | 112 | 117 |
| Volume cooling water in cu. ft. per minute | 61.8 | 61.8 | 61.8 | 61.8 | 61 | 61 |
| Barometric pressure | 25 | 25 | 25 | 25 | 25 | 25 |
| Average vacuum | 23.5 | 23.25 | 23 | 22.7 | 21.4 | 20.9 |
| Ave. temp. exhaust Fahr. | 89 | 85 | 99 | 100 | 110 | 119 |
| Total cu. ft. exhaust | 43.336 | 47.57 | 57.89 | 65.76 | 101.29 | 105.33 |
| Weight of exhaust per cu. ft. | 62.14 | 62.18 | 62.03 | 62.02 | 61.89 | 61.75 |
| Total weight of exhaust | 2692.9 | 2957.9 | 3591 | 4078.4 | 6268.8 | 6501.1 |
| Less seal leakage, lb. | 70 | 84 | 62 | 60 | 42 | 40 |
| Less condenser leakage, lb | 18 | 18 | 18 | 18 | 18 | 18 |
| Net weight exhaust, lb | 2604.9 | 2855.9 | 3511 | 4000.4 | 6208.8 | 6446.1 |
| Ave. indicated load, kw | 68 | 79 | 113 | 146 | 238 | 255 |
| Less consumption of generator field in kw | 3 | 3 | 3 | 3 | 4 | 4 |
| Load credited to turbine | 65 | 76 | 110 | 143 | 234 | 251 |
| Load in % of normal rating of turbine | 21.66 | 25.33 | 33.36 | 48.66 | 79.33 | 85 |
| Steam consump. per kw-hour | 40.07 | 37.58 | 31.92 | 27.97 | 26.53 | 25.64 |
| Dry steam con. per kw-hour | 39.52 | 37.06 | 31.48 | 27.58 | 26.16 | 25.29 |
| Dry steam per kw-hour corrected to 22 in. vacuum | 41.70 | 38.77 | 32.64 | 28.29 | 25.59 | 24.36 |

measurements on the gage glass and this is subtracted from the water fed to the boiler when figuring evaporation. No allowance has been made, however, for the oil required to heat this water up to the temperature at which it is blown off.

The boiler-room record for the month of March, 1910, is shown in Table III.

Using the tests taken on the steam turbines, pumps and ammonia compressor engine as a basis of calculation, it was found that the steam generated was used as shown in Table IV.

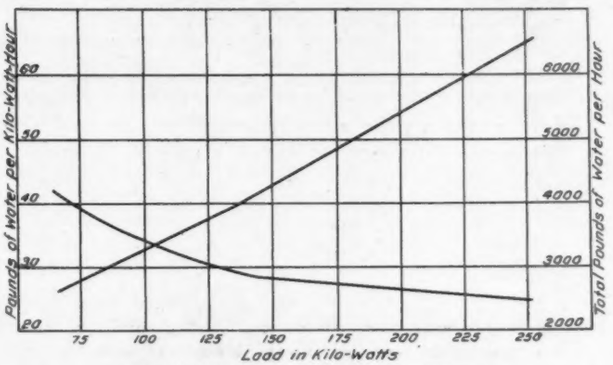



Fig. 4—Test of 300-Kw Steam Turbine.

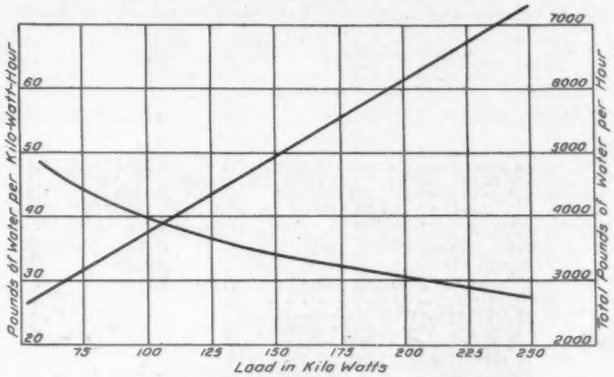



Fig. 5—Test of 500 Kw. Steam Turbine.

power-plant switchboard, is very good, and this, together with the reliable continuous service, has won many new customers for the company. The rates are fixed according to the average consumption of the customer, and in no case does this rate exceed 20 cents per kw-hour.

For the year 1909 the records for generating and transmitting electricity are shown in Table V.

The electrical energy recorded on the customers' meters was apportioned as shown in Table VI.

TABLE II.—TESTS OF 500-KW STEAM TURBINE.

| | Test 1. | Test 2. | Test 3. | Test 4. | Test 5. | Test 6. |
|---|---|---|---|---|---|---|
| Average r.p.m. of turbine | 3620 | 3620 | 3610 | 3600 | 3600 | 3600 |
| Ave. steam pres. throttle | 130 | 130 | 137 | 135 | 136 | 136 |
| " " " inlet | 13.5 | 18 | 26 | 49.6 | 53 | 64.8 |
| Quality of steam—% dry | 98.8 | 98.8 | 98.8 | 98.8 | 98.8 | 98.8 |
| Ave. temp. cool. water in | 70 | 75 | 78 | 79 | 80 | 80 |
| " " " " out | 80 | 87 | 91 | 98 | 99 | 103 |
| Volume of cooling water in cu. ft. per minute | 96.4 | 96.4 | 96.4 | 96 | 96 | 96 |
| Barometric pressure | 25 | 25 | 25 | 25 | 25 | 25 |
| Average vacuum | 24.12 | 23.12 | 22.8 | 21.8 | 21.3 | 20.6 |
| Ave. temp. exhaust Fahr. | 75 | 102 | 95 | 110.5 | 115.5 | 117 |
| Total cu. ft. exhaust | 43.865 | 49.892 | 67.33 | 103.277 | 102.14 | 121.207 |
| Weight exhaust per cu. ft. | 62.28 | 62 | 62.08 | 61.89 | 61.81 | 61.78 |
| Total weight exhaust, lbs. | 2731.9 | 3093.3 | 4180 | 6391.8 | 6313.3 | 7488 |
| Less turbine seal leakage | 132 | 121.5 | 99 | 80 | 82 | 70 |
| Less condenser leakage | 4 | 4 | 4 | 4 | 4 | 4 |
| Net weight exhaust, lbs. | 2595.9 | 2967.8 | 4077 | 6308.8 | 6227.3 | 7414 |
| Ave. indicated load kw | 61 | 69 | 108 | 201 | 218 | 255 |
| Less consump. gen. Field kw | 4 | 4 | 5 | 5 | 5 | 5 |
| Load credited to turbine | 57 | 65 | 103 | 196 | 213 | 250 |
| Load in % of normal rating of turbine | 11.4 | 13 | 20.6 | 39.2 | 42.6 | 50 |
| Steam consump. per kw-hour | 45.54 | 45.66 | 39.58 | 32.19 | 29.23 | 29.66 |
| Dry steam per kw-hour | 44.99 | 45.11 | 39.10 | 31.80 | 28.88 | 29.30 |
| Dry steam per kw-hour corrected to 22 in. vacuum | 48.52 | 46.98 | 40.26 | 31.11 | 28.15 | 27.80 |

Curve "A," in Fig. 6, shows the average indicated load for each of the 24 hours in the day during the month of June, and curve "B" shows the same for the month of December. The curve in Fig. 7 shows the salable output for each month of the year. In calculating this curve each month was taken as if consisting of 30 days.

Besides the smaller transmission lines to the suburbs there are four main lines of No. 00 copper wire, carrying the electricity a little more than a mile to the corner of the company's building near the center of the city. An oil switch, installed on the primary wires and located in the telephone exchange in this building, is used for switching the circuits on and off for all arc and incandescent street lamps. All service is metered, and the meters for the city are installed on the primary wires near the oil switch in the telephone exchange. Electricity for all business houses and residences is supplied through pole transformers. The voltage regulation, which is controlled by the automatic potential regulator on the

TABLE III.—BOILER-ROOM RECORD.

| | |
|---|---|
| Water fed to boilers, lb. | 4,320,547 |
| " used for blow off, lb. | 51,588 |
| " evaporated into steam, lb. | 4,268,959 |
| Fuel oil used, lb. | 318,347 |
| Actual evaporation per lb. of oil | 13.41 |
| Temperature of feed water, Fahr. deg. | 170 |
| Pressure of steam, lb. | 150 |
| Evaporation factor | 1.0925 |
| Evaporation from and at 212° Fahr., lb. | 14.65 |

The losses are distributed about as shown in Table VII.

There are in all 70 transformers of the old type connected to the lines. These range in sizes from ½ kw to 25 kw, and the calculations of core and copper losses were based on curves furnished by the manufacturers. The meter losses were found by carefully measuring the watts consumed by the shunt coils of each type of meter in service. No attempt was made to calculate the losses in the series coils, and these are thus not included in the meter losses as given in the table. There are in all 933 meters in service, and of these the shunt coil losses were found to be as shown in Table VIII.

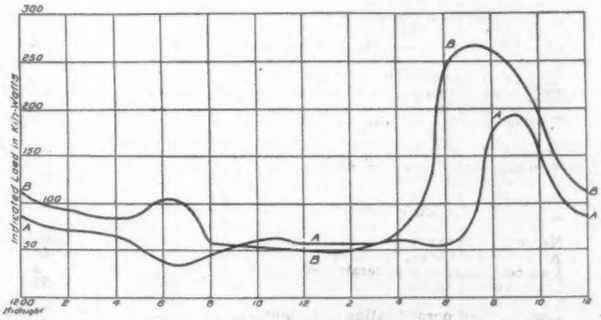



Fig. 6—Average Daily Load for June and December.

The company makes it a practice to test its meters as often as practicable, leaving no meter in service more than a year without being tested. All the meters are tested before being put in service, and those that have been in service as long as

TABLE IV.—DISTRIBUTION OF STEAM.

| | Lb. Steam | Lb. per Kw.-hour |
|---|---|---|
| **Electric Department** | | |
| Turbines (78,640 kw-hours produced) | 2,876,526 | 36.58 |
| Dry vacuum pump | 148,800 | 1.89 |
| Condensation pump | 49,104 | .62 |
| Proportion of general work (78.44 per cent) | 89,468 | 1.14 |
| " " steam for boiler feed (78.44 per cent) | 184,773 | 2.35 |
| Total used in electric department | 3,348,671 | 42.58 |
| **Ice Department** | | |
| Compressor engine and condenser pump | 730,392 | |
| Condensation pump | 13,550 | |
| Water pump for ice manufacture | 89,280 | |
| Circulating pump for thawing water | 11,688 | |
| Proportion of general work (21.56 per cent) | 24,591 | |
| " " steam for boiler feed (21.56 per cent) | 50,787 | |
| Total used for ice department | 920,288 | |
| **Boiler Room** | | |
| Boiler feed pump | 142,560 | |
| Steam used for oil burners (2.2 per cent) | 93,000 | |
| Total steam for boiler feed | 235,560 | |
| **General Work** | | |
| Pumping back from sump | 20,303 | |
| Pumping water for boiler cleaning | 5,196 | |
| " returning water from cooling tower to main supply tank | 88,560 | |
| Total used for general work | 114,059 | |

a year are tested on the customer's premises, a rotating standard being usually employed for this purpose.

The company also makes a practice of testing all the elec-

TABLE V.—RECORD FOR 1909.

| | | |
|---|---|---|
| Recorded at power house switchboard, kw-hours | | 861,110 |
| Used for exciter motors, kw-hours | 51,370 | |
| Used for circulating water pump motors, kw-hours | 65,665 | 117,035 |
| Amount salable, kw-hours | | 744,075 |
| Recorded on customers' meters | | 556,531 |
| Lost and unaccounted for energy | | 187,544 |
| Loss, per cent | | 25.2 |

trical apparatus received. A comparative efficiency test of five electric flatirons recently received from different manufacturers was thus conducted with results as given in Table IX. This test, which consisted of evaporating ½ lb. of water, was

TABLE VI.—DISTRIBUTION OF LOAD.

| | Kw-hours | Per cent of Energy Sold |
|---|---|---|
| Stores, theaters, etc. | 142,472 | 25.6 |
| Saloons, billiard, etc. | 114,645 | 20.6 |
| Residences | 86,263 | 15.5 |
| Hotels, rooming houses, restaurants, etc. | 72,349 | 13.0 |
| Electric motors | 61,218 | 11.0 |
| City street lamps | 48,975 | 8.8 |
| Churches, schools and Y.M.C.A. | 22,261 | 4.0 |
| Company's power plant lighting | 8,348 | 1.5 |
| Total | 556,531 | 100 |

conducted as follows: A small tin pan containing ½ lb. of water was placed on an asbestos mat and the cold iron was placed on two small pieces of wire in the bottom of the pan. The circuit was then closed and the iron left standing on the

TABLE VII.—DISTRIBUTION OF LOSSES.

| | Kw-hours | Per cent |
|---|---|---|
| Primary and secondary transmission losses | 49,853 | 6.7 |
| Transformer core and copper losses | 96,730 | 13.0 |
| Meters' potential coil losses | 27,412 | 3.7 |
| Stolen energy, slow meters and unaccounted for | 13,549 | 1.8 |
| Total | 187,544 | 25.2 |

wire pieces until the pan was nearly empty, when the wires were removed and the iron was placed on the bottom of the pan until all the water was evaporated. The initial temperature of the water was in all cases 59 deg. Fahr.

The cost of generating, transmitting, metering, administration, accounting and collecting for the electrical energy sold during the year 1910 is divided as indicated in Table X.

TABLE VIII.—LOSSES IN SHUNT COILS OF METERS.

| Type of Meter | Loss per Meter-Watts | No. of Meters in Service | Total Loss in Watts | Total Loss per Year Kw-hours |
|---|---|---|---|---|
| "A" (Induction) | 3.085 | 648 | 1,999.08 | 17,512 |
| "B" (Commutator) | 5.33 | 143 | 762.19 | 6,675 |
| "C" (Induction) | 2.06 | 89 | 183.34 | 1,606 |
| "D" (Induction) | 2.43 | 38 | 92.34 | 809 |
| "E" (Polyphase) | 6.17 | 15 | 92.55 | 810 |
| Total | | 933 | 3,129.50 | 27,412 |

The company tries to get all the latest and best electrical apparatus on the market and to get the customers interested in these by advertising and pointing out to them the advan-

TABLE IX.—POWER CONSUMPTION OF ELECTRIC FLATIRONS.

| Type of Iron | Power Taken, Watts | Time Consumed, Minutes | W.. minutes |
|---|---|---|---|
| "A" | 630 | 24 | 15,120 |
| "B" | 460 | 29.5 | 13,570 |
| "C" | 560 | 27.5 | 15,400 |
| "D" | 485 | 31.75 | 15,398 |
| "E" | 580 | 26.25 | 15,225 |

tages and great conveniences in using these devices. The tungsten lamp and the electric flatiron have thus come into common use, and a great number of small motors and heating

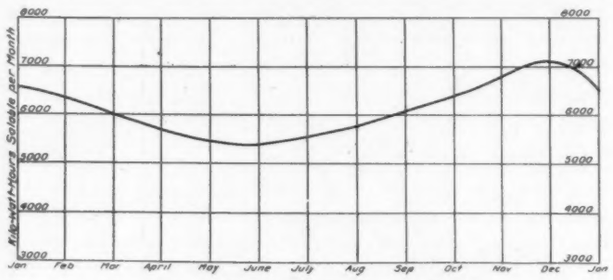



**Fig. 7—Salable Production for 1909.**

devices of all descriptions have been installed. Several electric vacuum cleaners, washing machines, dough mixers, etc., have also lately been introduced with success. It has been found that these devices have resulted in better satisfied customers, as well as in larger sales of electrical energy.

TABLE X.—DIVISION OF COSTS.

| | Per cent | Per cent |
|---|---|---|
| Power Plant Expense | | |
| Fuel oil | 31.36 | |
| Water | 3.47 | |
| Labor | 10.33 | |
| Repairs | 7.03 | |
| Depreciation | 11.36 | |
| Lubricating oil | .48 | |
| Taxes and insurance | .76 | |
| Other expenses | 1.49 | |
| Total power plant expenses | | 66.28 |
| Transmission Expense | | |
| Labor | 4.81 | |
| Horses, line wagon, etc. | 1.17 | |
| Depreciation to lines, transformers, etc. | 6.07 | |
| Materials for line repairs | .53 | |
| Taxes | .47 | |
| Other expenses | .54 | |
| Total transmission expense | | 13.59 |
| Meter expense | | 4.94 |
| Free street lamp maintenance expense | | .78 |
| Administration expense | | 5.43 |
| Accounting and collecting expense | | 6.10 |
| General expenses (not included in the above) | | 2.88 |
| Total expenses | | 100.00 |

## COMPARATIVE LIFE TEST OF INCANDESCENT LAMPS.

BY CLAYTON H. SHARP AND PRESTON S. MILLAR.

VERY little information is to be found in the technical literature of the subject regarding the accuracy with which, under good conditions, the life of incandescent lamps can be determined by life-test experiments. There is probably in the minds of many an impression that life-test results represent only a rough approximation to the truth and that the results of one period on a given set of lamps may be quite different from those obtained at another time. It is true that in few, if any, fields of testing work can worse results be obtained than are sometimes got in the life testing of incandescent lamps. Life tests conducted by men of insufficient experience or of insufficient training to appreciate the manifold precautions and the great care which must be taken in order to secure accurate results are practically worthless. Life-test results obtained, however, in a properly equipped and properly operated laboratory for the purpose should be accurate and consistent, and the results obtained in one such laboratory should agree with those obtained in another laboratory. Those actively engaged in life-test work in properly equipped laboratories have long known that consistent results were possible in their own work and have demonstrated it by tests.

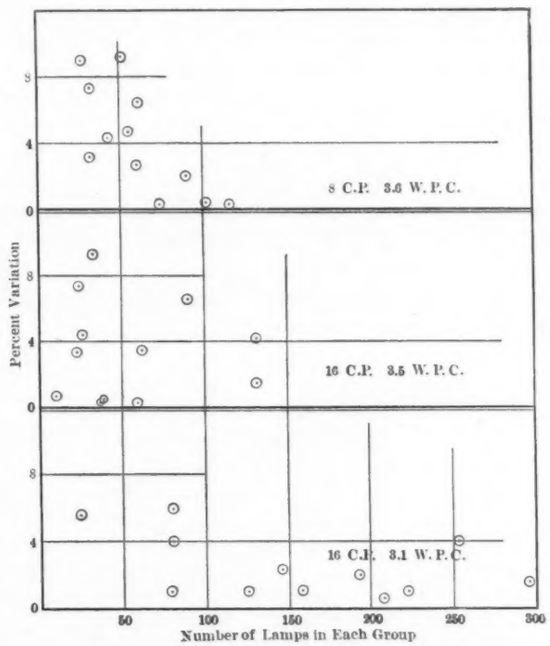



Fig. 1—Discrepancies in Life-Test Results.

Fig. 1 is offered as an illustration of the concordance obtained in tests made at different times in one laboratory, the data being abstracted from a part of the 1908-1909 testing records. It is the practice, whenever feasible, to divide a group of lamps which are to be life tested, placing half of them upon test immediately, and starting the test upon the other half of the lamps approximately two weeks later. Fig. 1 shows the differences between the two groups so tested. Each circle on the diagram indicates by its location the difference between the average useful life values of two particular groups, the number of lamps composing each of the groups being found by reference to the scale of abscissas. The comparison is a valid one in each case, because the lamps forming any two groups were burned at the same watts per candle initially, and were selected from the product of the same manufacturer, and as far as known, from approximately the same period of manufacture.

Considering first the 16-cp lamps of 3.1 initial watts per candle, which appear at the bottom of the plate, it will be seen that most of the differences lie within 3 per cent, the most notable exception being that two groups, numbering 253 lamps each, differed by 4 per cent. Examination of the records shows that one of these groups contained by chance much the larger proportion of lamps having defects which result in very short life. Indeed, it is fair to say that with regard to all of the

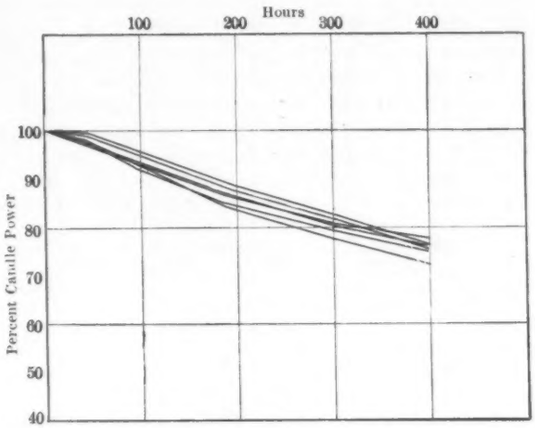



Fig. 2—English Lamps Tested at National Physical Laboratory.

larger variations indicated upon this diagram a similar explanation accounts for a large part of the differences noted.

In the case of the 16-cp, 3.5-watt lamps the differences were found to be somewhat larger, due to the well-established fact that these lamps are less uniform in their performance than are the 16-cp 3.1-watt lamps of the product here represented. The smaller carbon filament lamps are notably less uniform than the 16-cp lamps, which is easily apparent from the diagram, in which the variations are appreciably greater than those noted for the larger lamps.

In general, the diagram illustrates the fact that concordance of test results may be expected to vary considerably with the number of lamps represented in a test group, and with the uniformity of the product from which the test group is selected. Furthermore, if variations in the lamps tested could be eliminated, the concordance of the test results would be entirely satisfactory.

As to whether concordance can be expected in the results of

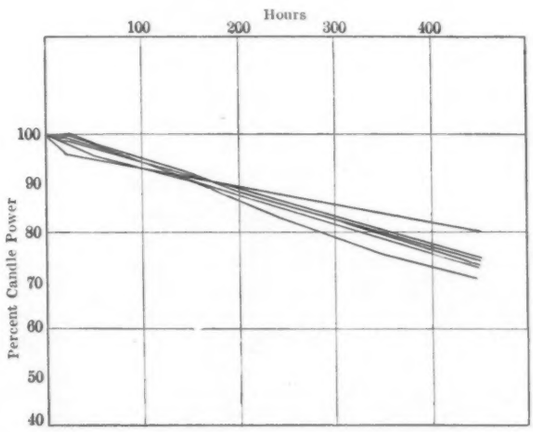



Fig. 3—English Lamps Tested at Electrical Testing Laboratories.

life tests conducted according to somewhat different practices in different laboratories widely separated from each other information has been entirely lacking. In view of this fact a comparative life test was agreed upon between the National Physical Laboratory, of London, England, Dr. R. T. Glazebrook, F.R.S., director, and the Electrical Testing Laboratories, New York. The results of this test, while not entirely con-

clusive because of the small number of lamps tested, are presented here as throwing light upon the subject of the obtainable accuracy in this class of work.

As a preliminary to the life test a comparison was made of standards of candle-power and of electromotive force, as follows:

The Electrical Testing Laboratories sent six standardized incandescent lamps to the National Physical Laboratory whereby a direct comparison of candle-power standards was achieved. The National Physical Laboratory sent a Weston normal cell of its own construction to the Electrical Testing Laboratories for purposes of comparison of the electrical units. At the time the test was made the international agreement as to the value of the unit of candle-power had not been entered into by the National Laboratories of England, France and the United States. Consequently, there was an outstanding difference in the value of the candle-power units in use, which, as shown by

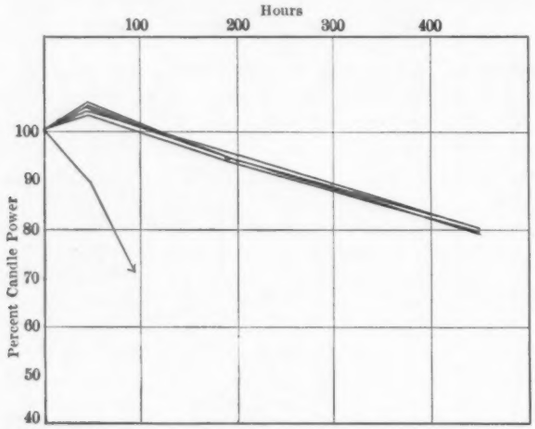



Fig. 4—American Lamps Tested at National Physical Laboratory.

the standard lamps, amounted to 1.1 per cent. In conducting the tests all electrical and photometric measurements were reduced to a common basis.

In preparation for the test 12 lamps of 16 cp were selected in each laboratory. These lamps were very carefully rated initially. The English lamps were burned for some hours before measurements were made. The lamps of each group were rated as nearly as possible at the same watts per mean horizontal candle-power. Six lamps of each of these groups were retained at the laboratory where prepared, and the other six were shipped to the other laboratory. Thus each laboratory had six of its own lamps and six of the other laboratory's lamps. The lamps were carefully re-rated at the other laboratory, and thereby a further check of the concordance of standards was obtained. The initial ratings of the English and American lamps as determined at the N. P. L. and E. T. L. are given in the following table:

TABLE I.—INITIAL RATINGS.

| American Lamps. Values assigned at | | | British Lamps. Values assigned at | | |
|---|---|---|---|---|---|
| No. | E. T. L. | N. P. L. | No. | N. P. L. | E. T. L. |
| 1 | 3.09 | 3.10 | 1 | 3.10 | 3.09 |
| 2 | 3.09 | 3.07 | 2 | 3.10 | 3.18 |
| 3 | 3.10 | 3.07 | 3 | 3.10 | 3.12 |
| 4 | 3.11 | 3.10 | 4 | 3.10 | 3.09 |
| 5 | 3.11 | 3.10 | 5 | 3.10 | 3.12 |
| 6 | 3.11 | 3.09 | 6 | 3.10 | 3.12 |
| | 3.10 | 3.09 | | 3.10 | 3.12 |

It will be noted that the rating of the British lamp No. 2 was quite different at the Electrical Testing Laboratories from what had been found at the National Physical Laboratory.

The rating tests being completed, and the results compared, the actual life test was begun. In both laboratories the life-test current was alternating, and the regulation of voltage was very close. The limit of voltage variation of their life-test lines is given by the National Physical Laboratory as ± ½ per cent. The voltage of the Electrical Testing Laboratories' lines certainly did not vary by more than this amount. The lamps were burned at their rated voltages as given by the laboratory in which they had been prepared until their candle-power had dropped somewhat more than 20 per cent below the initial value. Individual life curves were drawn for each lamp, and are reproduced in Figs. 2 to 5.

The American lamps tested at the E. T. L. burned initially at 3.09 watts per candle as against 3.10 watts per candle for the corresponding lamps at the N. P. L. An allowance of + 7 hours has been made in the measured life of these lamps to correct for this variation.

The final results are summarized in Table II. The American lamp which "slumped" in the N. P. L. tests has been disregarded. The average life value for each group is taken as the average of the lives of the individuals composing the group.

TABLE II.—LIFE VALUES.

| | N. P. L. Test | E. T. L. Test | Difference |
|---|---|---|---|
| English lamps | 312 hours | 341 hours | 29 hours=9.3% |
| American lamps | 434 " | 434 " | 0 " |
| English lamps, No. 2 out | 312 " | 315 " | 3 " =1% |

The concordance of the results on the American lamps is surprising. The difference in the case of the British lamps is greater, but still the agreement is satisfactory. If we eliminate from the results the British lamp which showed a consumption

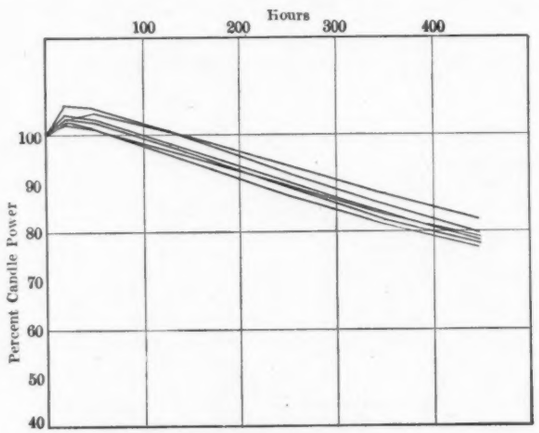



Fig. 5—American Lamps Tested at Electrical Testing Laboratories.

of 3.18 watts per candle at the E. T. L., and which had therefore an unduly long life, the comparison becomes considerably more favorable. The average of the British lamps tested in the E. T. L. is then 315 hours and the difference between the N. P. L. and E. T. L. values is only three hours, or 1 per cent. As has been said above, the results of this test are not entirely conclusive because of the small number of lamps involved. This point is emphasized by the data in Fig. 1. However, when irregular lamps are eliminated and data are reduced to the same basis as far as possible, a valid comparison of the results of the respective laboratories' methods may be expected. It is safe to say that if there were any radical or considerable discrepancy between the results of life tests conducted at the National Physical Laboratory and the Electrical Testing Laboratories, a test of the character here described would almost certainly disclose it. No discrepancy having shown itself, it is fair to assume that none exists, and that the life-test results of these two laboratories may be taken as equivalent. It

follows, moreover, that any two laboratories properly equipped and conducted may be made to agree in their results in life-testing lamps.

In conclusion, the fact should be emphasized that no comparison is possible between the quality of the British and that of the American lamps on the basis of this test. The spherical reduction factors of the two groups of lamps were quite different, so that the two groups actually burned at quite widely different watts per mean spherical candle, or watts per lumen. Moreover, as has been said, the British lamps had been burned for a considerable period before the beginning of the test.

An account of this test, from the point of view of the National Physical Laboratory, is given by Messrs. Clifford C. Paterson and E. H. Rayner, M.A., in the London *Electrician. Electrical Testing Laboratories.*

## THE ELECTROSTATIC CAPACITY BETWEEN EQUAL, PARALLEL WIRES.

BY H. PENDER AND H. S. OSBORNE.

IN the *General Electric Review* for July, 1909, and in the succeeding numbers, is published an extensive series of tables of transmission line constants, covering a wide range of sizes and separations of wires. On the editorial page of the July number this statement is made regarding the computation of these tables:

"The formulas customarily used, and which involve approximations that lessen the labor of calculation at the expense of refinement, have not been employed. Accurate formulas have been used wherever the error would otherwise have affected the result within the limits of the retained digits."

It appears, however, that this statement requires some qualification. Table II (published in the July *Review*) gives values for the capacity between a pair of solid wires for sizes of wire from No. 4-0 to No. 15, and for distances between centers from 3/8 in. to 180 in. The formula given for the computation of these values is

$$C = \frac{3.677}{\log \frac{D-r}{r}} \text{ microfarads per 1,000,000 ft.} \qquad (A)$$

where $D$ = distance between centers of wire
and $r$ = radius of each wire.

This formula, as is well known, is an approximate one, and is a close approximation only for relatively large values of $\frac{D}{r}$. The result of applying it to a table of capacities, such as Table II of the *Review* series, is to introduce an error which is serious for a considerable part of the table, *and which amounts, in the worst case, to 330 per cent.*

[1]See Alexander Russell, Alternating Currents, Vol. 1, Pages 99-102. Cambridge University Press, 1904.

An exact formula[1] for the capacity between two equal cylinders must take into account the non-uniformity of the distribution of charge on the cylinders; such a formula is found by considering the charges to be concentrated at the inverse points of the cylinders, and is given by the equation

$$C = \frac{3.677}{\log [\alpha + \sqrt{\alpha^2 - 1}]} \text{ microfarads per 1,000,000 ft.} \qquad (B)$$

$$\text{where } \alpha = \frac{D}{d} = \frac{\text{Distance between centers of conductors}}{\text{Diameter of either conductor}}$$

This exact formula is not very formidable, and it is, moreover, practically solved for one who has within reach a table of hyperbolic cosines[2], for

$$ln [\alpha + \sqrt{\alpha^2 - 1}] = \cosh^{-1} \alpha$$

(when *ln* represents the natural logarithm). The exact formula in its simplest form is then

$$C = \frac{8.467}{\cosh^{-1}\alpha} \text{ microfarads per 1,000,000 ft.} \qquad (C)$$

Values for the capacity have been computed from equation (C) for all cases given in Table II of the *General Electric Review* in which the error introduced by the use of their equation (A) exceeds 0.2 of 1 per cent, and are collected in Table I. These values have been carefully checked, and are believed to contain no error greater than 0.1 of 1 per cent in magnitude.

The values given in this, or in any other table of capacities, may be extended to sizes and distances beyond the scope of the table by remembering that if the distance between the centers of the wires be doubled, and the wires be taken six sizes larger, the capacity remains nearly the same. That is, the capacity between two No. 18 wires 6 in. apart is nearly equal to the capacity between two No. 12 wires 12 in. apart.

From curve B, Figs. 2 and 3, may be read the magnitude of the error caused by the use of equation (A) with any given value of the ratio of the diameter to the distance apart of the wires. It is seen that the error amounts to ½ per cent for two No. 4-0 wires spaced 12 in. apart, and increases very rapidly as the separation of the wires decreases below this value.

The formula

$$C = \frac{3.677}{\log \frac{D-r}{r}} \text{ microfarads per 1,000,000 ft.}$$

is frequently given as an exact formula, even in standard text-books and in papers before the American Institute of Electrical Engineers. The reasoning customarily used in deriving this formula is somewhat as follows:

[2]A table of hyperbolic cosines sufficient for all ordinary cases is printed in B. O. Pierce's *Short Table of Integrals.* A very complete set of tables of hyperbolic functions has recently been published as the *Smithsonian Mathematical Tables* (G. F. Becker and C. E. Van Orstrand, 1909).

TABLE I.—ELECTROSTATIC CAPACITY OF CONDENSER FORMED BY EQUAL PARALLEL WIRES.

$$C = \frac{8.467}{\cosh^{-1}\frac{D}{d}}$$ microfarads per million feet of line (two million feet of wire).

| Distance apart Inches | 000 | 000 | 00 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .... | ..... | 35.86 | 15.44 | 11.26 | 9.185 | 7.882 | 6.962 | 6.264 | 5.713 | 5.262 | 4.883 | 4.562 | 4.282 | 4.037 | 3.820 | 3.627 | 3.451 | 3.294 |
| 2 | 20.45 | 12.97 | 10.12 | 8.498 | 7.405 | 6.603 | 5.985 | 5.485 | 5.073 | 4.723 | 4.422 | 4.161 | 3.930 | 3.724 | 3.540 | 3.374 | 3.224 | 3.086 | 2.960 |
| 3 | 7.906 | 6.978 | 6.270 | 5.725 | 5.271 | 4.891 | 4.568 | 4.288 | 4.043 | 3.825 | 3.630 | 3.456 | 3.298 | 3.154 | 3.022 | 2.901 | 2.790 | 2.687 | 2.591 |
| 1 | 5.997 | 5.495 | 5.088 | 4.731 | 4.428 | 4.166 | 3.935 | 3.729 | 3.544 | 3.378 | 3.227 | 3.089 | 2.963 | 2.847 | 2.739 | 2.640 | 2.548 | 2.462 | 2.381 |
| 2 | 3.939 | 3.733 | 3.548 | 3.382 | 3.230 | 3.092 | 2.965 | 2.849 | 2.742 | 2.642 | 2.642 | 2.463 | 2.383 | 2.307 | 2.237 | 2.170 | 2.107 | 2.048 | 1.992 |
| 3 | 3.304 | 3.160 | 3.028 | 2.907 | 2.795 | 2.691 | 2.595 | 2.506 | 2.423 | 2.345 | 2.272 | 2.203 | 2.138 | 2.077 | 2.020 | 1.966 | 1.914 | 1.865 | 1.819 |
| 4 | 2.968 | 2.852 | 2.744 | 2.644 | 2.551 | 2.465 | 2.385 | 2.309 | 2.238 | 2.171 | 2.109 | 2.050 | 1.994 | 1.940 | 1.890 | 1.843 | 1.797 | ..... | |
| 5 | 2.752 | 2.651 | 2.558 | 2.472 | 2.390 | 2.315 | 2.243 | 2.176 | 2.113 | 2.054 | 1.998 | 1.944 | 1.894 | 1.846 | 1.801 | ..... | ..... | ..... | |
| 6 | 2.597 | 2.507 | 2.424 | 2.346 | 2.273 | 2.204 | 2.140 | 2.079 | 2.021 | 1.967 | 1.915 | 1.866 | 1.820 | ..... | ..... | ..... | ..... | ..... | |
| 7 | 2.480 | 2.398 | 2.322 | 2.250 | 2.183 | 2.119 | 2.059 | 2.003 | 1.949 | 1.899 | 1.851 | 1.805 | .. | ..... | ..... | ..... | ..... | ..... | |
| 8 | 2.386 | 2.311 | 2.240 | 2.173 | 2.110 | 2.051 | 1.995 | 1.942 | 1.891 | 1.844 | 1.798 | | | | | | | | |
| 9 | 2.309 | 2.238 | 2.172 | 2.109 | 2.050 | 1.994 | 1.941 | 1.891 | 1.843 | 1.797 | ..... | | | | | | | | |
| 10 | 2.245 | 2.177 | 2.115 | 2.055 | 1.999 | 1.946 | 1.895 | 1.847 | 1.802 | ..... | ..... | | | | | | | | |
| 11 | 2.189 | 2.125 | 2.065 | 2.009 | 1.955 | 1.904 | 1.855 | 1.809 | | | | | | | | | | | |
| 12 | 2.141 | 2.080 | 2 022 | 1.968 | 1.916 | 1.867 | 1.821 | | | | | | | | | | | | |
| 15 | 2.027 | 1.972 | 1.920 | 1.871 | 1.824 | | | | | | | | | | | | | | |
| 18 | 1.942 | 1.892 | 1.844 | 1.799 | | | | | | | | | | | | | | | |
| 21 | 1.876 | 1.829 | 1.784 | | | | | | | | | | | | | | | | |
| 24 | 1.822 | 1.777 | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | |

See General Electric Review, July 1909, for values not included in this table.

Given two wires (Fig. 1), whose axes are parallel and separated by a distance $D$, each of which has a radius $r$ charged with $Q$ units and $-Q$ units, respectively, of electricity per unit length. Assume that the two charges are uniformly distributed over their respective cylinders. (This assumption is not true except for small ratios of $\frac{D}{r}$.) Under this condition the electrostatic field intensity at any point $P$ external to the wires

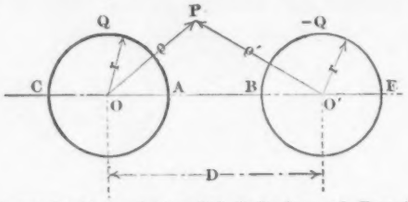



Fig. 1—Cross-Section of Parallel Cylinders of Equal Radius.

is equal to that which would be produced by two changes $Q$ and $-Q$ per unit length concentrated on the axes $O$ and $O'$ of the wires, and is hence given by the equation

$$F = \frac{2Q}{\rho} - \frac{2Q}{\rho'} = 2Q\left(\frac{1}{\rho} - \frac{1}{\rho'}\right)$$

The potential $V$ is $-\int F d\rho$; hence the potential difference between the two cylinders is found by integrating between $B$ and $A$, and is equal to

$$V_o = 4Q \ln \frac{D-r}{r} \qquad (D)$$

It is evident, however, that if instead of choosing B and A as the limits of integration, one had integrated from E to C, the formula for the potential difference would become

$$V_o' = 4Q \ln \frac{D+r}{r} \qquad (E)$$

Evidently the true value for the potential difference between the two wires can be neither of the values given by (D) and

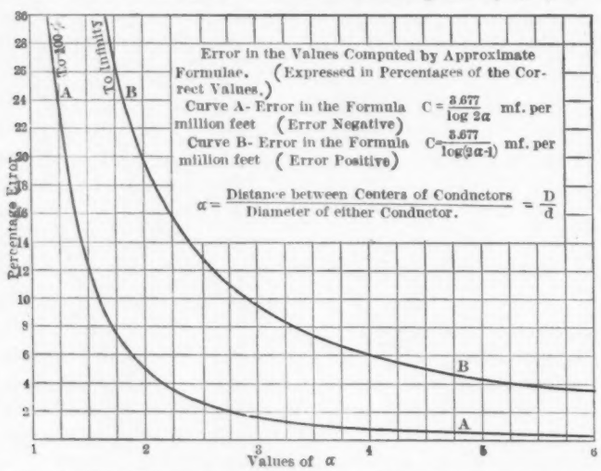

Error in the Values Computed by Approximate Formulae. (Expressed in Percentages of the Correct Values.)
Curve A- Error in the Formula C = 3.677 / log 2α mf. per million feet (Error Negative)
Curve B- Error in the Formula C = 3.677 / log(2α-1) mf. per million feet (Error Positive)
α = Distance between Centers of Conductors / Diameter of either Conductor. = D/d
To 100%
To Infinity
A
B
Percentage Error
Values of α

Fig. 2—Comparison of Formulas for Capacity Between Long Parallel Cylinders of Equal Radius.

(E), but must be somewhere between those two values. It might then be reasonably expected that the simple equation,

$$V = 4Q \ln \frac{D}{r} \qquad (F)$$

which is a sort of logarithmic mean between the two extreme equations, (D) and (E), would give more accurate results than either of them.

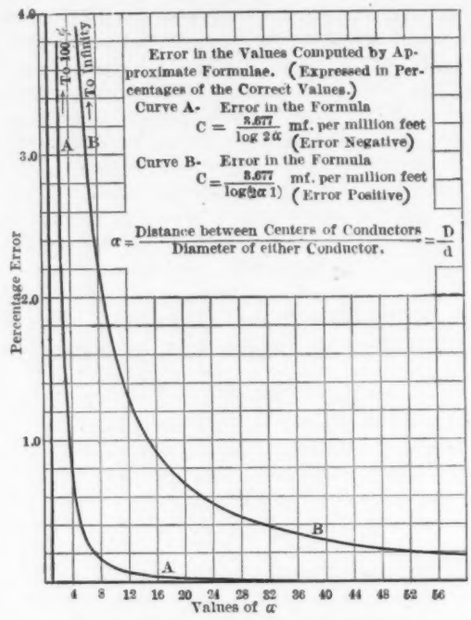
Such is indeed the case. The equation for the capacity between two wires obtained from equation (D) is

$$C = \frac{3.677}{\log(2\alpha - 1)} \text{ microfarads per 1,000,000 ft.} \qquad (G)$$

and that obtained from equation (F) is

$$C = \frac{3.677}{\log 2\alpha} \text{ microfarads per 1,000,000 ft.} \qquad (H)$$

where $\alpha$, as before, is the ratio of the distance between centers to the diameter of the wires. Figs. 2 and 3 show the error introduced by the use of equations (G) and (H) for different values of $\alpha$, expressed as percentages of the correct value of the capacity. It is seen that equation (G), that used in the


Error in the Values Computed by Approximate Formulae. (Expressed in Percentages of the Correct Values.)
Curve A- Error in the Formula C = 3.677 / log 2α mf. per million feet (Error Negative)
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α = Distance between Centers of Conductors / Diameter of either Conductor. = D/d
To 100%
To Infinity
A
B
Percentage Error
Values of α

Fig. 3—Comparison of Formulas for Capacity Between Long Parallel Cylinders of Equal Radius.

*General Electric Review*, introduces an error which is in all cases very much greater, and in the limit (when $\alpha = 1$) is infinitely greater than that introduced by equation (H). Equation (H) is hence not only simpler than equation (G), but it is also more rational and much more exact.

The equation

$$C = \frac{3.677}{\log 2\alpha} \text{ microfarads per 1,000,000 ft.} \qquad (H)$$

gives values which are lower than the correct values, and which become seriously in error for values of $\alpha$ less than 5 or 6.

The error in this approximate formula for very small values of $\alpha$ does not seem remarkable when one considers the actual

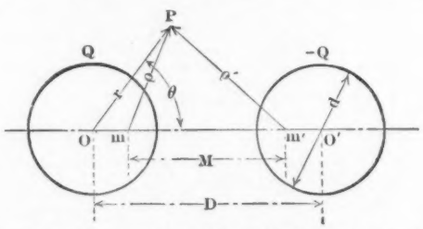



Fig. 4—Cross-Section of Parallel Cylinders of Equal Radius.

distribution of charge on the conductors in these cases. This actual distribution of charge may be calculated as follows:

Given two parallel wires (Fig. 4), having charges of $Q$ and $-Q$, respectively, per unit length. Let $O$ and $O'$ be the centers of the wires, and $m$ and $m'$ their inverse points. Then

$$(Om)\,(Om') = \left(\frac{d}{2}\right)^2$$

or

$$M^2 = D^2 - d^2$$

Take polar coördinates $(r, \theta)$ about $O$. Then the potential at any point $P$ is

$$V = 2Q \ln \frac{\rho'}{\rho} = Q \ln \frac{r^2 + \left(\frac{D+M}{2}\right)^2 - r(D+M)\cos\theta}{\left(r^2 + \frac{D-M}{2}\right)^2 - r(D-M)\cos\theta}$$

$$= Q \ln \frac{A}{B}$$

where $A$ and $B$ represent the numerator and the denominator, respectively, of the antilogarithm.

Then

$$\frac{\delta V}{\delta r} = \frac{QM}{AB}\left[\left(\frac{d^2}{2} + 2r^2\right)\cos\theta - 2rD\right];$$

or when $r = \frac{d}{2}$, i.e., at the surface of the wire

$$\left(\frac{\delta V}{\delta r}\right)_{r=\frac{d}{2}} = \frac{QM}{AB}\left[d^2\cos\theta - dD\right]$$

Moreover,

$$AB = \left[r^2 + \left(\frac{D+M}{2}\right)^2 - r(D+M)\cos\theta\right]\left[r^2 + \left(\frac{D-M}{2}\right)^2 - r(D-M)\cos\theta\right]$$

Hence, when $r = \frac{d}{2}$, $AB$ reduces to the form

$$AB = \frac{d^2}{4}[D - d\cos\theta]^2$$

Hence

$$\left(\frac{\delta V}{\delta r}\right)_{r=\frac{d}{2}} = \frac{-4MQ}{(D - d\cos\theta)\,d}$$

the surface density of the charge on the conductor is then

$$\sigma = -\frac{1}{4\pi}\left[\frac{\delta V}{\delta r}\right]_{r=\frac{d}{2}} = \frac{Q}{\pi d}\,\frac{M}{D - d\cos\theta}$$

Or since $M = d\sqrt{a^2-1}$, where $a = \frac{D}{d}$,

$$\sigma = \frac{Q}{\pi d}\,\frac{\sqrt{a^2-1}}{a - \cos\theta} = \sigma_0\frac{\sqrt{a^2-1}}{a - \cos\theta}$$

where $\sigma_0 = \frac{Q}{\pi d}$ = average surface density of the charge.

This is the polar equation of an ellipse having its major axis in the line connecting the center of the two wires, and one focus at the center of the wire in question, the other focus being a distance $\frac{2\sigma_0}{\sqrt{a^2-1}}$ toward the other wire. The surface density of the charge at any point $P$ on the surface of the wire

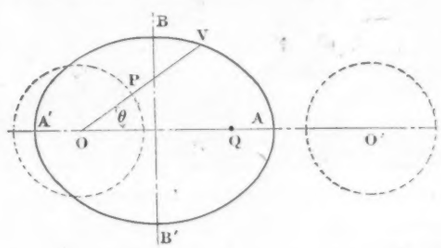



Fig. 5—Distribution of Charge on Two Long Parallel Cylinders.

is then equal to the radius vector $OV$ of the ellipse having one focus at $O$, the other focus a distance $OQ\,\frac{2\sigma_0}{\sqrt{a^2-1}}$ toward the other wire, the major axis $AA' = \frac{2\sigma_0 a}{\sqrt{a^2-1}}$ and the minor axis $BB' = 2\sigma_0$.

It is apparent from the ellipse (Fig. 5) that the ratio of maximum to minimum density is $\frac{OA}{OA'} = \frac{a+1}{a-1}$. For large values of $a$, then, the charge is distributed very nearly uniformly, and the equation

$$C = \frac{3.677}{\log 2a} \text{ microfarads per 1,000,000 ft.}$$

gives very accurate results. For small values of $a$, however, the ratio of maximum density to uniform density is large, giving a distribution very far from uniform. Fig. 6 shows the distribution for the case of No. 000 conductors spaced ½ in. on centers. In this case $a$ equals 1.087, and the ratio of maximum density to minimum density of charge is 24. Almost the entire charge on each conductor is on the side nearer the other conductor. Considering this fact it does not seem strange that the approximate formula, which assumes a uniform distribu-

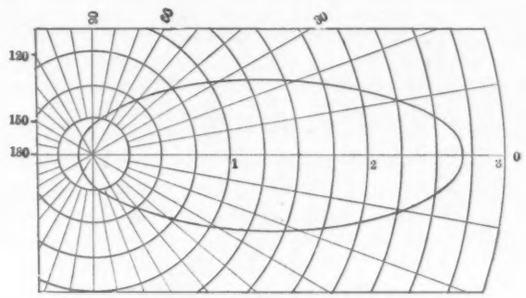



Fig. 6—Surface Density of Charge.

2—No. 0000 wires, ½ inch apart, 1000 volts between wires.

$$\sigma = \frac{V}{4\cosh^{-1}a}\cdot\frac{1}{\pi d}\cdot\frac{\sqrt{a^2-1}}{a - \cos\theta}$$

Where V is in c.g.s. electrostatic units and d in centimeters; $a = 1.087$.

tion of charge, gives a result which is 47 per cent below the actual value.

The criticism which has been made of the values given in Table II of the transmission line constants in the *General Electric Review*, which gives the capacity between solid conductors, applies also to Table XVI, which gives the capacity between stranded cables. In this case even the formula (C) cannot be relied upon to give perfectly exact results, for the surfaces of the conductors are no longer cylindrical.

The tables of charging current are, of course, in error to the same extent as those of the corresponding capacities. In this connection it should be remembered that for small values of $a$ the capacity of a three-phase line cannot be accurately assumed to be equal to $\frac{2}{\sqrt{3}}$ times the corresponding single-phase value. As far as the authors know, however, no accurate formula has yet been developed for three-phase capacity, so one must perforce be content with approximations.

*Summary.*

(1) The exact formula for the capacity between two parallel cylindrical wires of equal radius is

$$C = \frac{3.677}{\log[a + \sqrt{a^2-1}]} \text{ microfarads per 1,000,000 ft.} \quad (B)$$

or

$$C = \frac{8.467}{\cosh^{-1}a} \text{ microfarads per 1,000,000 ft.} \quad (C)$$

where $a = \frac{D}{d} = \frac{\text{Distance between the centers of the conductors}}{\text{Diameter of either conductor}}$

(2) For values of $a$ of 10 or greater, the approximate formula

$$C = \frac{3.677}{\log 2a} \text{ microfarads per 1,000,000 ft.} \quad (H)$$

introduces an error of less than 0. of 1 per cent.

(3) The formula

$$C = \frac{3.677}{\log(2a-1)} \text{ microfarads per 1,000,000 ft.} \quad (G)$$

is much less accurate than formula (H), and should, therefore, not be used.

(4) The distribution of charge on either of two parallel equal wires may be represented by an ellipse constructed in the manner above described; or, the density of charge may be computed by using the formula

$$\sigma = \frac{V}{4\cosh^{-1}a}\cdot\frac{1}{\pi d}\cdot\frac{\sqrt{a^2-1}}{a - \cos\theta} \quad (J)$$

This equation is in electrostatic c.g.s. units.

(5) A considerable portion of the tables of capacity and of charging current printed in the July, 1909, number, and in subsequent numbers, of the *General Electric Review* is seriously in error, due to the use in computing them of an approximate formula. The top line of Table II of capacities is displaced one number to the right, and the first three values given are slightly smaller than those which would be computed from the formula given.

## THE ELECTRICAL EQUIPMENT OF AN AIRSHIP.

By Frank B. Rae, Jr.

Equipping an airship with a complete lighting system, telephone system and wireless outfit is not an everyday affair with the average electrical man, so perhaps a description of the plant which has just been put aboard the Wellman-Vaniman transatlantic dirigible *America* will prove sufficiently unusual to be interesting.

The *America* was briefly described in these pages Sept. 8, page 559, in connection with an article on the wireless system used. She is 228 feet long, has a lifting power of 2400 pounds, carries 1800 gallons of gasoline, is propelled by two gasoline motors of 80 hp each, and on her attempt to cross the Atlantic Ocean will be manned by a crew of six. The details of her construction were worked out by Mr. L. T. Vaniman, who was associated with Mr. Walter Wellman in his attempts to reach the North Pole by airship from Spitzbergen in the summer of 1909. The electrical equipment, however, was designed and installed by Mr. B. R. Whelan, of the Buckeye Electric Company, assisted by Mr. J. R. Irwin, of the Marconi Wireless Telegraph Company. The difficulties they had to overcome were many, for transatlantic airship construction has not reached a point where methods and materials are standardized, and each problem had to be solved as met.

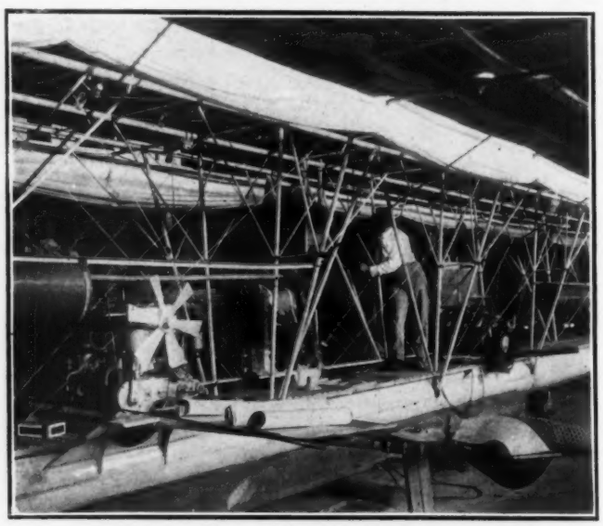
The equipment consists of a ¼-kw, shunt-wound, 10-amp., direct-current Hawthorne generator of 1500 r.p.m.; a 12-cell storage battery; a three-station automatic telephone set; a special Marconi wireless outfit, having a range of about seventy-five miles, and eight 20-volt, 25-watt tungsten lamps equipped with Holophane steel reflectors. The conductors used were of special make on account of the necessity for extra-strong insulation.

The two main difficulties in designing the installation were the necessity for perfect insulation and flexibility of the generator. The insulation problem arose from the fact that the steel frame or nacelle of the ship serves as the aerial of the wireless station. The other difficulty was caused by the necessity of providing against the stoppage of any one or two of the three engines, in which event the generator would have to be moved and connected to a live engine. To procure adequate insulation, a special conductor was specified, consisting of No. 8 gage stranded copper covered with a fine asbestos shield and immersed in rubber solidified to a coating of ⅛ in. thickness. This was then spun with jute to give tensile strength and the strands woven, encased in fabric and treated to fireproof solution. On puncture test this insulation withstood 26,000 volts between terminals. The flexibility of the generator entailed the building of three frames, one at each engine, and providing three sets of pulleys and belts to secure the proper speed at each engine. To devise adequate circuits to take care of this portable feature, multiple cable was run from the forward to the after engine and a double-throw switch installed so as to open this multiple at such times as the generator is being operated for reverse position, thus avoiding all chance of grounding on the nacelle.

The Marconi apparatus is operated in multiple with the lamps, and the fluctuation, which is comparatively slight owing to the small power, 250 watts, is taken care of by the use of extra-heavy copper. The circuit is so devised that, should the battery fail, both the wireless apparatus and the lamps can be operated from the generator direct. The main switchboard is located, as may be seen from the picture, midway between the two main engines. In addition to the switchboard instruments, however, the wireless operator is supplied with special instruments to note his discharge and the generator will of course be run only upon his instructions. The wireless station is located in the lifeboat, which will be swung under the nacelle of the airship, where it will be away from the noise of the motors. The connections between the nacelle and the lifeboat are centered in a master plug which can be broken in an emergency, thus safely and quickly severing all electrical connections.

The picture here reproduced shows Mr. J. R. Irwin, the wireless operator and electrician of the expedition, standing at about the middle of the nacelle. In the foreground is one of the shafts for driving the helices or propellers. The nearest engine is of 80 hp. Farther along the car is the service engine of 10 hp which will operate an air pump to refill the bag as the gas escapes, thus keeping the balloon from becoming deflated and losing rigidity. The service engine also operates winches for handling material between the lifeboat and the nacelle, and may further be used to drive the generator if necessary. Directly beside the service engine is the hatchway through the steel tank which lets down to the lifeboat in which are the storage batteries and wireless apparatus. Beside this hatch is the switchboard and farther back is the second engine.

The lighting equipment consists of eight 20-volt, 25-watt tungsten lamps in Holophane steel reflectors located in the



**Electrical Equipment of the Dirigible, America.**

nacelle over the working platform. A lamp is provided for the binnacle, one for log, one over each of the three engines, two at the observation cabin in the stern of the ship, and one in the lifeboat for the wireless operator. The lamps are burned at somewhat more than their rated voltage, as the transatlantic trip will be short and it is desired to secure exceptionally brilliant illumination for short periods. On this account also Holophane reflectors were employed to increase the efficiency to the maximum.

As may well be imagined, the wiring of the *America* was a most careful piece of work, every foot of conductor, every joint and every connection being tested independently by both of the engineers in charge. The cable, where exposed, is carried in porcelain cleats screwed to large wooden blocks which are lashed to the nacelle with insulated cordage. Where it is necessary to run along the framework or through the steel tank covers, the cable is encased first in flexible duct and then in ⅛-in. fiber tubing. The switchboard also is well insulated from the frame of the ship by wood rubber and heavy fiber between each connection and the steel tubing to which it was lashed. If the *America* fails to reach Europe it will not be from any fault of her electrical equipment.

# FALL CONVENTION OF NEW ENGLAND SECTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

## Abstracts of Papers and Discussions.

The fall convention of the New England Section of the National Electric Light Association was held at the Griswold Hotel, Eastern Point, New London, Conn., on Sept. 13 and 14. About 250 persons were in attendance, including ladies and distinguished guests, and the meeting was marked by an informality characteristic of a large house party, which contributed much to the personal enjoyment of those present. President and Mrs. Alex. J. Campbell, of New London, were untiring in hospitality, and the work of Messrs. C. H. Hodskinson, Boston, master of transportation; Wm. M. Lewis, Rockville; F. S. Price, Boston, and E. R. Davenport, Providence, members of the committee on entertainment, was responsible for a large share of the enjoyable time which everyone reported. Secretary L. D. Gibbs, Boston, officiated in inimitable fashion at various social events, and the interest of the business sessions was enhanced by the presence of President W. W. Freeman and Executive Secretary T. Commerford Martin of the National organization.

Most of the party reached New London on the afternoon of the twelfth, delegations from Providence, Boston and points north arriving on three special parlor cars attached to the 3 o'clock New York express from Boston. President Campbell, of the New England Section, met the train at New London, and the party disembarked waving about a hundred New England Section pennants by way of salutation. The usual steamer trip was then made to Eastern Point, and the evening was spent in delightful interchange of greetings, informal technical discussions, walks on the moonlit shore and dancing. The hotel had been specially kept open for the convention, and the number of other guests was so small as to afford the maximum degree of pleasure from the gathering. The usual reception was omitted.

Registration of members and guests began on Tuesday morning, and before the opening of the business session the entire party participated in a flag raising on the lawn of the hotel, the halliards being arranged so that each one in a large semicircle could help in pulling the Stars and Stripes into place, the proceedings being much enlivened by the performances of an amateur drum and fife corps equipped with toy horns, peaked paper caps and miniature drums. As the flag was raised it was followed by a large blue and white New England Section flag 20 ft. long and 10 ft. and 5 ft. wide, a duplicate being flown over the hotel at the same time.

The business session was called to order by President Campbell, who welcomed the party in the most cordial fashion, and urged that the discussions of the papers be of the freest character. Secretary Gibbs then read his report, pointing out the value to the section of its permanent headquarters and assistant secretary in Boston, at the Edison Building, and urging the membership to make the fullest use of the facilities there offered. At the time of the first annual meeting of the section in March, 1910 there were 564 members, and on Sept. 1 there were 688, showing a gain of 68 class B members and 47 in class E.

President W. W. Freeman, of the N. E. L. A., was then introduced. After expressing his pleasure at the welcome extended, he stated that the question of organization is being given special consideration in the association at the present time. He urged the desirability of securing more company memberships, since at present there are less than half of all the companies in the country on the rolls of the association, although from 90 per cent to 95 per cent of the capital invested in the industry is in the organization. Mr. Freeman said that the influence of the organization ought to be larger in the industry and throughout the country as a whole, and the three objects of education, inspiration and protection can better be attained if the organization of the association is comprehensive throughout the United States. He then referred to the plan to have standing committees cover the entire field of central-station work so that loose ends may be taken up and gaps in the educational work of the organization avoided. Inspiration plainly comes from combined efforts, while in regard to protection, the parent organization really stands in the relationship of the big brother to the geographical and company sections. It is desirable to reach the point where the national organization will wield an influence throughout the country capable of affording ample protection to all the member companies in the vicissitudes of their careers. Mr. Freeman then pointed out the advantage of handling many local matters by company sections, and concluded by congratulating the New England Section upon its rapidity of growth and its pioneer work in showing that loss of identity does not accompany membership in the national body.

President Campbell then delivered his address, which emphasized the responsibility of the New England Section in the face of its growth, touched upon the benefits of the permanent headquarters, and outlined the plan for the interchange of opinions and experiences through the headquarters as a clearing house. It appeared to be the better plan to maintain headquarters in a single place rather than to attempt to locate quarters wherever the presidency of the section happened to be each year. Brief reference was made to the forthcoming establishment of the Thomas Davenport memorial by the Vermont Electrical Association at Brandon, Vt., on Sept. 28 and 29. President Campbell referred briefly to the project to erect an engineering club building in Boston and the desirability of favorable consideration of the matter, and closed with a short discussion of the importance of the topic of central-station rates at the present time. He emphasized the value of campaign to increase and diversify loads upon revenue, and pointed out the tendency of State commissions to adopt restrictive decisions in rate cases, so that it is most important for all companies to be able to defend their rates before these tribunals. The introduction of the tungsten lamp has presented many important questions for solution, but perhaps the subject of rates is the most vital confronting the industry at present. Whatever the New England Section does in the matter of rates will be noted with interest by the commissions. In conclusion Mr. Campbell spoke of the reappearance of flat rates for certain lines of work, and pointed out that previous ideas on the subject are in a state of flux.

A paper was then read, the writer being Mr. Howard Corning, treasurer of the Bangor Railway & Electric Company, on "The Advantages of a Uniform System of Rate-Making." Following this was a discussion by Messrs. A. B. Lisle, W. H. Blood, Jr., W. L. Mulligan and R. W. Rollins. Abstracts of the papers and discussions are printed in another column.

The committee on the Thomas Davenport celebration then made its report, and the section voted to accept it. A tablet to the memory of the inventor who produced the first successful electric motor, in the year 1834, will be unveiled at Brandon, Vt., on Sept. 28. The committee was composed of Messrs. E. D. Blackwell, Brandon, Vt.; W. G. Meloon, Dover, N. H., and F. D. Gordon, Lewiston, Me.

The committee on statistics and information, Mr. R. W. Rollins chairman, reported that success had attended the effort to establish a clearing house of information at the Boston headquarters of the section. Questions of contracts, prices, life of lamps, heating problems and construction matters have already formed a considerable part of the inquiries and a body of data of no little value is being accumulated.

Telegrams of greeting were received from Past-president James E. Davidson, of Portland, Ore., and C. H. Hodskinson, Boston.

Mr. T. Commerford Martin, executive secretary of the association, was then called upon. Mr. Martin pointed out the remarkable recent growth of the national body, which had 3200 members only a year ago, but which now has 5792 enrolments. It appears neither wise nor safe to print less than 7000 sets of the *Proceedings* this year. One of the most important matters considered by the association this year has been a classifica-

tion of accounts, one copy of which has been sent to each company in the organization. There has been much valuable interchange of information among the companies that have adopted this classification. Mr. Martin said that each president had brought some special idea to the association, and that the present executive had been particularly happy in co-ordinating and correlating the committee work, avoiding sporadic and spasmodic efforts and the promotion of hobbies. He touched upon the growth of company sections, noting an attendance of over 400 at a recent meeting in Brooklyn within the confines of a single company. Mr. Martin emphasized the fact that no attempt has been made by the association to force additions to its membership. Nebraska and Georgia have been welcomed into the ranks within the past three months. Speaking of the problem of admitting representatives of municipal plants to membership, Mr. Martin said that the association had taken a firm stand against this policy on account of its conviction that the municipalization of public service is attended by disadvantages, wastes and ills which render private enterprise the proper custodian of the electric lighting and power industry. Concluding he said that the smaller companies are the ones which naturally benefit most from membership in the association, and that all should be brought into the organization for the good of the art.

On Tuesday afternoon the entire party enjoyed a steamer trip to Fisher's Island N. Y., where Fort Wright was visited through the courtesy of the commanding officer, Lieut.-Col W. F. Rafferty, U. S. A. The party were given an opportunity to inspect in detail the installation and operation of 10-in. and 12-in. disappearing rifled guns of the most modern type; the barracks were visited and a competitive mortar battery drill was given for the benefit of the visitors. The hospitalities were concluded by a concert on the parade ground in front of Officers' Row, the music being rendered by the Eleventh Artillery Band, one of the most noted organizations of its kind in the service.

A banquet was held at the Griswold in the evening, and at its conclusion President Freeman, of the national association, was called upon for a word of greeting, after which Secretary L. D. Gibbs gave a most interesting lantern-slide talk upon "Illuminated Advertising," a résumé of which is given elsewhere in this issue.

On Wednesday morning the ladies of the party were given a delightful automobile ride in the vicinity of New London, including a visit to the Plant estate and the Pequot section of the city.

The business session Wednesday morning opened with a discussion of Secretary Gibbs' paper on illuminated advertising, in which Messrs. H. T. Sands, F. B. Ras, J. J. Dawes, E. R. Davenport, G. W. Teffeau, F. W. Prince, C. R. Hayes, J. E. Spike and W. H. Blood, Jr., participated. Votes of thanks were then passed to Lieut.-Col. Rafferty, U. S. A., and various gentlemen in New London for hospitalities rendered the convention. President W. H. Blood, Jr., of the Electric Vehicle Association of America, then outlined the purposes and possibilities of that organization.

A paper was then read by Mr. J. A. Hunnewell, general superintendent Lowell (Mass.) Electric Light Corporation, on "Special Decorative Street Lighting." Following this was a long discussion in which Messrs. Sands, A. T. Holbrook, J. J. Dawes, C. R. Hayes, A. B. Lisle, Bryan Ray, E. P. Roweil, Rollins, E. J. Richards, Lewis Schwabe, Addis, Townsend and Blood took part. A résumé of the paper and discussion is given in another column. The final paper of the convention was by Mr. Levin J. Chase, manager of the Concord (N. H.) Electric Company, his topic being "Opportunities." There was no discussion, and the convention adjourned at noon.

Abstracts and discussions of papers follow.

### UNIFORM SYSTEM OF RATE-MAKING.

In opening his paper on "The Advantages of a Uniform System of Rate-Making" Mr. Howard Corning, treasurer Bangor Railway & Electric Company, emphasized the increasing importance of the subject of rates in the face of enlarged demands for electric service by the public and stated that benefits should result from an explanation to the public at large of the attitude of central-station managers and the basis upon which charges for electricity are made. When electricity was first introduced the method of charging was of the simplest, and everyone understood it, and to-day a company starting in a small town will make all its rates of the simplest character. In large communities the variety of service offered as well as the variety of the demand upon the plant require a more complex system of charging.

Mr. Corning stated that simplicity of rates is one of the most valuable elements of any system, but that it can be carried to such an extent that it will hinder the growth of the company and work injustice to customers. It was his opinion that rates will be multiplied as business grows, provided always there is some broad ground on which such differences in rates can be founded. Out of fifty replies to recent inquiries, about twenty admitted the maintenance of special rates, and practically all were willing to abandon them. It is probable that some of these so-called special rates were in reality founded on some broad difference which could be satisfactorily explained.

It would appear from this that it would not be a difficult matter to find some basis on which a general agreement on rates could be founded. The Bangor company feels that special rates which cannot be justified by varying conditions are not good policy for any public-service company. It may be that two or three divisions of rates may be sufficient, inasmuch as the classification will be very general, but under any number of heads into which rates are divided there ought to be at all times special considerations which perhaps it is best to leave to individual companies in order that they may meet local conditions. There are marked differences between steam-plant and hydro-electric-plant conditions, to say nothing of the wide variations in the cost of coal between inland and seaport towns. Again, a central station may be a few miles from the population served instead of in the center of the community, necessitating the maintenance of a high-tension transmission line with transformer and line losses. There is also a wide variation in the franchises under which different companies operate, not only as between cities and towns, but as between states. Again, there are some companies which serve a very much larger population in the summer than in winter, the result of which is a very much higher rate than if there were a normal ratio between summer and winter business. These points indicate the objections which occur against any attempt on the part of the National Electric Light Association to bring about a general agreement of rates. It is desirable, however, to take up the questions of broad classifications of service, and the best principles upon which charges for such service can be made. Mr. Corning closed by saying that he had been unable to find any discussion of classification which would apply to a territory such as one group of states or a single state. He felt that if the New England Section could arrive at some classification of service on which the member companies could make charges according to the demand and their ability to serve it would be a great benefit in helping to solve the rate problem.

#### DISCUSSION.

Mr. A. B. Lisle, general manager Narragansett Electric Lighting Company, Providence, R. I., said that he knew of no other form of public service in which the rate question is so pressing as in central-station work. The water companies recognize the readiness-to-serve charge by a fixed rate per faucet plus an additional charge for extra faucets. The telephone companies have found the necessity of a moderate initial charge plus a message rate. Gas companies are not involved in this question to any extent on account of their ability to store their product. Mr. Lisle considered it impossible to make a detailed plan for a uniform system of charging, but any approximation to it is greatly to be desired in its effect on the standing of a company in its community. It is out of the question to attempt to make a system of rates which will apply to the small and large city equally. Simplicity of rates is the most desirable consideration. It is hard to make rates which are equally fair to the long-hour and the short-hour user. It may be well to graduate rates according to the size of the towns, but it

is most important to avoid multiplication of charges and complexity in their arrangement.

Mr. W. H. Blood, Jr., of Stone & Webster, Boston, pointed out the permanence of rate problems. He felt that actual rates should not be discussed so much as the underlying principles of charging. The great trouble is that the central-station man thinks he is selling a service, while the public thinks it is buying a commodity. These two ideas must be harmonized, and an aid to that result will be the improvement in the load factor. The electric vehicle, ice-making, water heating by the Therol system, etc., should help in the matter. The three fundamental objects to be sought in rate-making should be simplicity, non-discrimination and profit. Mr. Blood did not feel that there is much prospect of ever making the demand system plain to the public, although companies must make some kind of a readiness-to-serve charge and then institute a low kw-hour rate since the public is familiar with all purchases on a commodity basis. Discounts may be based on quantity used. Uniformity in the system of charging is more important than a slight amount of discrimination.

In discussing the general subject of rates Mr. R. W. Rollins, general manager of the Hartford Electric Light Company, submitted an interesting by-product in the form of a contributed paper upon the question of a reasonable return for public utilities. Mr. Rollins said that it is probable that at the next session of the Connecticut Legislature a public-utilities commission will be established and the consideration of a proper law in this connection must include some very important facts not ordinarily given sufficient publicity. Interest on government bonds varies from 2 per cent to 4 per cent according to their life and applications. Mortgages on such properties as electric light and railway companies vary from 4 per cent to 6 per cent, and of late the best classes are offered freely at 5 per cent. In order to attract investment in electric light and power companies the capitalist must be offered some advantages over and above what he can obtain with good security without any business risk for money invested in such corporations at about 5 per cent, otherwise he will simply buy the bond instead of taking his chances in a somewhat precarious and variable business. A well-managed electric company which tries to supply the public at the lowest possible price has to bear in mind three sources of expense: First, it must be remembered that its machinery, owing to the fluctuations in its value from excessive wear and tear and from improvements, depreciates steadily. Second, changes in income growing out of improvements in lamps have steadily cut down income on the meter basis. Third, it is necessary to employ very high-priced skill in management, a class of labor which is dearer than any similar class used by corporations, and which arises from the risks of the business and the necessity of a good deal of scientific knowledge which can only be acquired at high-priced schools.

Such a company, if faithfully serving its community at the lowest prices, ought to earn at least 5 per cent over and above the interest on the capital invested at 5 per cent. Three per cent of the capital invested is needed for the maintenance of the company in an up-to-date condition, and this allowance is made in Hartford and was reported to the government in relation to the corporation tax. In a growing town service rendered necessitates a steady increase of capital for supplying new machinery and new means of furnishing current. In Hartford the street commission has decided that about two miles of underground construction should be built yearly. This method of distribution does not increase the revenue of the company and should be paid out of earnings, otherwise there will be a steady and large depreciation of assets, as the old lines must all be taken down. As to other developments for an increased business it is a question whether new capital should steadily be added on which earnings must be made in order to obtain cash, or whether these should be obtained from earnings on the present capital, and this ought to be considered from a local point of view in every case.

Closing, Mr. Rollins said that the foregoing figures are not in any way adapted to propositions where money has been wasted or where stock has been watered in order to obtain unfair returns, but are based on an actual outlay and actual returns as experienced in Hartford.

Mr. W. L. Mulligan, Springfield, Mass., cited the difficulties encountered in quoting a rate to the owner of similar stores in a considerable number of cities in New England. A study of the rates in force in twenty-nine such stores owned by the same organization showed that it was impossible to find any two of the stores where the rates were the same. The need of investigating this topic was apparent. It was later voted to have the president appoint a committee on rates to report at the next convention in March, 1911.

### ILLUMINATED ADVERTISING.

Mr. L. D. Gibbs, superintendent of advertising, Edison Electric Illuminating Company, Boston, in his paper with the above title stated that it was needless to argue in favor of electric signs, but he called the attention of the audience to the possibilities of stereopticon lectures as an aid to public-utility companies in educating the public regarding their work. About 100 lantern slides were shown and the author's discussion of the subject took the form of a lecture on a lecture, a typical talk to a popular organization being outlined. Mr. Gibbs stated that the matter of creating a better understanding of corporate problems and methods is extremely important. Every locality has numerous clubs, business men's, clubwomen's organizations, improvement associations and church societies which always have more or less difficulty in filling out their programs for the winter's work. Lectures in which the operation of a public utility is described are always popular, and in the past two years a noteworthy campaign in this direction has been made in Boston, not only by the Edison company, but by the Boston Elevated Railway Company. The growth of the company, what is being done for the general welfare of the public, fundamental principles of electrical applications, early apparatus contrasted with new, latest types of current-consuming devices, and particularly domestic applications, described with lantern slides leave the audience in a very happy frame of mind and are of great value to the company's good will. After the framework has been built and the illustrations secured, from all sources the following subjects can easily be handled, practically with one set of slides: "The History of Electric Lighting"; "The Past, Present and Future of Electricity"; "Electricity and the Servant Problem"; "Store, Window and Sign Lighting"; "Electricity the Physician of the Future"; "The Conservation of Our National Resources"; "The Home Electrical"; "Factory Lighting and Power"; "How a Raindrop Makes an Electric Light," etc.

In reviewing a typical lecture Mr. Gibbs exhibited a series of slides showing the usefulness of electricity in the home from early morning to midnight, including breakfast-table cooking, power applications, bell-ringing, sewing-machine and many other services, concluding with the application of the electric heating pad after the post-theatrical rarebit. In conclusion the author discussed electrical display advertising with numerous slides as a text, pointing out that originality and suggestion are the vital considerations. This type of advertising does not have to be purchased by the reader, and its cost is a minimum considering the "circulation."

#### DISCUSSION.

Mr. H. T. Sands Tenney Companies, Boston, said that electric sign and window advertising reaches a larger number of people than newspaper publicity. Mr. F. B. Rae, New York, called attention to the anti-sign campaign now in progress in New York City, and Mr. F. C. Bates, New York, emphasized the need of using good taste in all sign work. Mr. J. J. Dawes, Pawtucket, voiced the need of diplomacy in pushing sign installations on account of the possible hostility of the newspapers. Mr. E. R. Davenport, Providence, R. I., reviewed recent experiences in which the advertising of certain types of liquid refreshments had aroused so much hostility on the part of the public that the city authorities had passed severe ordinances greatly restricting the opportunity to install and maintain even the most unobjectionable signs. The Providence law now prohibits the erection of any sign advertising a product not made or sold in the particular building where it is displayed. Mr. G. W.

Teffeau, Rockville, Conn., stated that a similar stringency exists in Washington, D. C., and Mr. F. W. Prince, Hartford Electric Light Company, cited agitation by a local art society which had greatly injured the electric sign business in the city. Mr. F. B. Rae, New York, raised the question of refusing to supply energy to signs advertising liquors, following the practice of certain magazines which refuse objectionable business. Mr. C. R. Hayes, Fitchburg, doubted if it would be practicable to discriminate in this way, and Messrs. H. T. Sands and E. R. Davenport agreed that it would be difficult formally to refuse to give this service, although it can be avoided in solicitation, according to Mr. J. E. Spike, Cambridge.

### SPECIAL DECORATIVE STREET LIGHTING.

In introducing his paper entitled "Notes on Special Decorative Street Lighting" Mr. J. A. Hunnewell, Lowell Electric Light Corporation, contended that the rush to special or decorative street lighting is largely an hysteria resulting from too long suppression of efficient, complete and satisfactory street illumination. The possibilities of rearrangement are most attractive. Properly lighted streets are the best customer on the company's lines, and the service should be fostered more faithfully than that of the largest store. Too often municipalities have been unwilling to pay for the latest or best system or else the personal equation of the heavy taxpayer has played too large a part in the location of the lamps. The burden of responsibility in many cases lies with the central station, which may have at times failed to recommend the efficient system needed. Ninety per cent of the citizens see the electric light company in its street illumination. The best lighted street carries the greatest crowd, increased lighting increases traffic, and where traffic is densest the property value is highest.

The improvement will be greatest in the business section and the important question is whether the city or the merchants will pay for it. Over 75 per cent of such improved lighting in all Western cities has been paid for by the merchants themselves. Whether the merchants or the city pay for the improved lighting the people must be informed upon the subject. The newspapers will aid with descriptive accounts of what other cities are doing and point to local possibilities. These accounts may be accompanied by effective advertising in local papers by the central station, outlining tentative plans for an installation and benefits to be derived. It will not be difficult to find some party among the merchants or in the city government that will gladly carry the attack along, and a judicious amount of personal solicitation by the company among property owners and merchants will bring up the rear. At the proper time the proposed system can be installed along some typical block or street that the contrast and improvement may be seen. It may pay to provide a band concert the night the trial installation is lighted. The best time to broach the matter is when the street-lighting contract is about to be renewed.

Mr. Hunnewell advocated eliminating the spectacular and in cities with narrow, crooked or shaded streets using tungsten instead of arc lamps. Arc lamps do not lend themselves to strictly decorative lighting, but produce good illuminating results and minimize the number of poles and fixtures on the streets. If economy is imperative, trolley poles may be utilized. It is imperative that the system shall consist of a continuous line of light. Ornamental standards should be selected that carry the lamps in a pendent position to avoid shadows. The paper concluded with a terse description of the ornamental street lighting now in use in some fifty-four cities, mostly of the Middle West, including a tabulation of its cost, origination, principal dimensions, hours of burning, etc. The arch and festoon system, Daniels boulevard system, tungsten cluster and arc methods of ornamental lighting were reviewed, and representative installations illustrated by photographs. The author stated that the best decorative street lighting he had seen is at Indianapolis, and the details of the service were given, especial emphasis being laid upon the use of pressed-steel posts supporting five 100-watt tungstens in opalescent diffusing globes, with provision for controlling each block by switches and for operating one lamp only per cluster late at night.

### DISCUSSION.

Mr. H. T. Sands, Boston, touched upon the need of more civic pride in securing proper street lighting and favored the ornamental post with tungsten lamps for the service on the ground of its dignity. Luminous arcs do not appear desirable for New England ornamental service. He considered the Indianapolis plan expensive. At Mishawaka, Ind., the cost is much less, the total investment being from $1.30 to $1.50 per duct foot. There the merchants clubbed together and presented the city with the equipment and the latter maintains the service. The Indianapolis merchants pay about $1.05 per front foot per year. Ornamental brackets holding four lamps and 5 ft. long can be used on trolley poles at a cost of about $28 each.

Mr. A. T. Holbrook, New York, said that the Indianapolis work was marked out block by block. A prominent merchant in each block was furnished with a petition to the lighting company asking the latter to furnish a given number of lamps and brackets at $1.05 per front foot per year. This rate pays for the fixtures in three years, and nets a rate of about 5 cents per kw-hour for energy used. Practically the entire business section of the city is thus equipped. A somewhat similar plan is being tried in Altoona, the rate being $1.44 per front foot per year. Five blocks have now been equipped.

Mr. J. J. Dawes, Woonsocket, R. I., thought that merchants in New England would not be willing to pay for special street lighting on the front-foot basis. He felt that special street illumination might conflict with sign lighting. Mr. C. R. Hayes, Fitchburg, Mass., stated that store-window lighting on flat-rate, long-hour lines tended to improve street illumination as a whole. Its logical sequence is sign work, followed by additional street service. Mr. A. B. Lisle, Providence, cited the use of 10-amp magnetite arc lamps for temporary service in place of flame lamps, without requiring circuit changes of a costly character. Mr. H. T. Sands, Boston, said that there is no harm done if extra street lighting does curtail sign lighting. The sale of energy is the desideratum. Messrs. Sands and Holbrook stated that neither sign nor window lighting in Indianapolis had interfered with the other. Mr. F. B. Rae, New York, said that as an extreme case there was practically no window lighting in St. Louis on account of the powerful illumination of the streets. Mr. E. P. Rowell, Plymouth, Mass., corroborated this, and pointed out instances of how difficult it is to get farmers to pay for extra street lighting in their village center. Mr. E. J. Richards, Gardner, Mass.; Mr. W. M. Lewis, Rockville, Conn.; Mr. D. F. Townsend, Woonsocket, and Mr. Schwabe, of Windsor Locks, cited instances of the tungsten lamp replacing arcs with resulting better street lighting. The inhabitants of small towns often object to the removal of arc lamps on account of their "urban" effect, but usually a demonstration circuit of tungstens converts the most sceptical. In Windsor Locks four 60-cp tungsten lamps replaced each arc in two blocks with an increase of 9 per cent in street illumination and a reduction of 30 per cent in energy supplied. Mr. Addis, Brattleboro, said that there is danger of merchants in New England economizing too much on inside lighting if the front-foot basis of charging is proposed for extra street illumination. The discussion was closed by Mr. W. H. Blood, Jr., Boston, who condemned electric sign lighting as a necessary evil. He said that, in his opinion, sign lighting is on the wane; that the billboard crusade logically includes the electric sign, and that it is a passing, objectionable business. It would pay central-station managers to devote more attention to the great variations in the amount of energy used in street illumination per square foot of highway area. A recent study showed that there were variations of 500 per cent in this work. He advocated building up the load by other means, and felt that many other lines of expansion are better worth following in the way of energy-consuming devices.

President Campbell commented on the importance of the spirit of civic improvement and the desirability of the section's acting in accord with it, and called upon Mr. L. J. Chase, manager of the Concord (N. H.) Electric Company, to read the final paper of the convention.

### PUBLIC POLICY.

In his paper, entitled "Opportunities," Mr. Chase discussed in inimitable fashion his experience as a central-station manager after about twenty years in an entirely different business and without previous technical training. He described his efforts to remove the natural prejudice which the public is prone to cherish against a public-service corporation, and made a powerful plea for liberal conceptions in dealing with the public, condemning in the most positive manner adherence to hidebound traditions, rules, precedents and systems, many of which were created to meet conditions that no longer exist. Among the practices criticised were the use of technical terms in talking with customers, holding aloof from ordinary commercial enterprises, hesitation to break away from routine methods and lose a dollar to get two back, disputing with customers over matters of trifling importance and making trivial charges for trivial services. The paper outlined the efforts of the writer to align the company with the progressive elements of the community and the enforcement of patience, courtesy and dignity between employees and in public dealings. Personal relations with customers were fostered, and their importance was reviewed, particularly with reference to the conversion of hostile critics into stanch friends. The importance of adapting one's attitude to the customer instead of treating all men alike was touched upon, good relations with the press and city officials were urged, and the paper closed with an eloquent plea for mutual helpfulness and confidence between employer and employee and the placing of the business upon the highest plane compatible with a sound commercial policy. The paper formed a fitting climax to the convention, illustrating in a marked degree the power of personality in the successful administration of central-station service.

## CONVENTION OF THE PENNSYLVANIA ELECTRIC ASSOCIATION.

### Abstracts of Papers and Discussions Presented at the Meeting.

The third annual convention of the Pennsylvania Electric Association was held at the Glen Summit Springs Hotel, Glen Summit Springs, Pa., on Sept. 14, 15 and 16. The convention was the most successful ever held by the organization and in point of attendance was said to be the largest given by any geographical section of the National Electric Light Association. The sessions were held in the chapel located in the park at the rear of the hotel, and were very well attended. On the evening prior to the actual work of the convention a reception was held in the parlors of the hotel.

### PRESIDENT'S ADDRESS.

In his address at the opening session, the president, Mr. E. L. Smith, of Towanda, briefly related the short history of the association, stating that at its organization three years ago there were one dozen members, while the membership at the present time, including all classes, totals 464. He outlined the progress made in the art during that time and called attention to the present financial stability of the industry. The necessity of a new-business department in even small stations was emphasized, and Mr. Smith dwelt on the cordial relations existing between the national body and the state organization, giving in substance the policy of the national body toward the geographical sections, and the particular fitness of each to carry on certain specific branches of work for the furtherance of the industry. The Question Box, he felt, was of inestimable value and he advised all member companies to adopt the uniform methods of accounting as outlined in the report of the national committee having that work in charge. In concluding his address he recommended the appointment of two additional standing committees—one on rates and the other on lamps. The organization at present has standing committees on overhead-line construction and on steam heating in connection with central stations. The recommendations of the president were later carried into effect by vote of the association.

The report of the executive committee and that of the secretary and treasurer were followed by the presentation of the report of the committee on overhead-line construction. This followed along the same lines as last year's report, with the addition of a criticism of the report of the committee on the preservation of wooden poles and cross-arms and a general report on the joint occupancy of pole lines by telephone and electric light companies based on Mr. Paul Spencer's paper read at the 1908 convention of the N. E. L. A. at Chicago. The report was divided into five sections, as follows: (1) Criticism of the report of the national committee on overhead-line construction; (2) report on the specifications for line construction on poles jointly used by electric light and telephone companies; (3) criticism of the national report on the preservative treatment of poles and cross-arms; (4) the sag and span question, by Messrs. Wendle and Robertson; (5) specifications for insulating friction tape.

### OVERHEAD-LINE CONSTRUCTION.

While studying the report to the national organization, the committee was greatly impressed with the necessity of keen criticism from the men actually familiar with the details of secondary construction, the numerous minor faults and troubles experienced in the operation of a secondary system of distribution, and the methods employed in overcoming these troubles. This clearly shows that the line foremen and trouble finders must be consulted before the report can be of any value, as it covers a section of the work which has heretofore been left almost entirely to such men, which may account for the lack of uniformity in construction methods. The state committee brought out the points which seemed of greatest importance to it, adhering to the various divisions followed in the national report. Under "Poles and Pole Setting" the committee has nothing new to offer except the suggestions that where lines are built on private rights-of-way or in the rear of houses, etc., the use of smaller poles than are specified for ordinary line construction is desirable. On the stringing of secondary wires nothing of importance is recommended; but in the installation of transformers, fuse blocks, etc., the committee has some recommendations of moment. The Pennsylvania state committee feels that under certain conditions the grouping of transformers on a secondary system is desirable for lighting residential districts, and suggests the following: Transformers should be fused on both the primary and secondary sides. The transformers should be fed from a separate primary loop, which can be disconnected either by a switch or a fuse so as to permit the re-fusing of the transformers should they fail, due to a heavy circuit. No heavy loads should be connected, such as churches, halls, etc., as the connecting of such loads will account for many of the troubles formerly experienced by the grouping of transformers. The question is one which will require considerable study by the local engineer, for if load conditions are carefully figured on it is felt that by banking transformers a considerable saving in the transformers connected can be effected. The method suggested for the erection of transformers is in accordance with standard practice. The wiring on transformer poles should be done with a wire not smaller than No. 6 rubber-covered and it is suggested that all primary leads running to transformers should be coiled near the transformer with not less than six turns, each turn having an approximate diameter of from 2.5 in. to 4 in. The advisability of inserting these turns in the primary leads was seriously questioned at the St. Louis convention of the N. E. L. A.

On the question of "Why are transformers fused?" the committee is a unit in the opinion that it is done to protect from heavy short-circuits rather than overload conditions. It felt that the association should express a decided opinion on the matter in order that manufacturers should be familiar with the conditions under which their transformers will be operated. The committee is of the opinion that the use of lightning arresters is largely one of faith, although no doubt their proper

installation has avoided many accidents. The methods of installation as authorized in the national report are not questioned, except that the committee does not think it advisable to use the grounded neutral of a secondary system for a lightning arrester ground, as it is extremely likely that many lightning discharges would enter buildings, causing considerable damage. The installation of lightning arresters, in the opinion of the committee, depends on local conditions, and the number required is largely a matter of conjecture; the advisability of frequent installations depending on the amount of trouble that has been experienced, which may warrant the outlay of considerable money to afford what may be termed "safe operating conditions."

With reference to the section on "Consumers' Services" the suggestions in the national report are in accordance with the ideas of the state committee except that the latter feels that open cable running, securely fastened on insulated fixtures between the end of the secondary leads of the transformers to an iron pipe extending up the pole 10 ft. from the ground, is not a first-class method and should be avoided, as the saving effected by such an installation is very slight and the method unsafe.

The section of the national report dealing with "Railroad Crossings" is of interest, according to the committee, but has no particular bearing on ordinary line construction methods. The Pennsylvania state committee wishes to go on record as stating that, in its opinion, it is unwise to furnish special construction of any kind over railroads where such lines are for ordinary voltages only, or voltages up to and including 6600-volt systems, including under this heading constant-current series lighting systems.

Regarding the joint use of poles the committee recommends that the joint use of poles be avoided wherever possible and that every company endeavor to maintain a clear right-of-way of its own, making all extensions on its own poles and avoiding the attachment of poles of the other company. This, in the opinion of the committee, will without doubt furnish the most satisfactory operating conditions for both companies. The committee then briefly states a few of the important points brought out, with the recommendation that where joint agreements are found necessary the specifications of the N. E. L. A. be carefully studied. The committee feels that the clause relating to the vertical runs of cables upon poles should be changed to prohibit the running of wires down the pole except when such wires are attached to the ends of the cross-arms, which will place them in such a position as to be entirely removed from possible contact with linemen climbing the pole. Some changes are recommended in the voltages of lines on joint poles as follows: Constant-potential metallic circuits not to exceed 6600 instead of 5000; alternating-current series circuits not to exceed 7500 instead of 5000 as heretofore.

With reference to the report of the committee on the preservative treatment of poles and cross-arms the state committee found this the most difficult to criticise, for the reason that it had been so ably prepared by men who have made a careful study of the subject. The committee concludes that ordinary paint will preserve the life of the timber to a small degree and that brush treatment with a preservative oil is of much greater benefit. It also suggests the advisability of the various companies throughout Pennsylvania considering the matter of treatment of poles having in view the erection of a plant run on a co-operative basis under the supervision of competent men, who will not be bound to any one system or grade of preservative.

In view of the inconsistencies of the present formulas and solutions for sags and spans investigations were made into the fundamental factors involved in an exact solution of the sag question. Through the courtesy of the Philadelphia Electric Company Mr. W. L. Robertson was enabled to make careful observations and collect data for accurately determining the form of curve assumed by a suspended wire and other fundamental data. These have formed the basis of extended researches and calculations, and while the solution is now in sight considerable calculations remain to be done before the tables and data are in shape for use by the ordinary lineman. While these data seem to upset the practice of many years, they bring up many questions of importance heretofore entirely ignored. The committee then took up the question of spans and sags at crossings and the general conditions of the work at such points imposed on electric light companies by the railroads. It concludes its report with specifications for insulating friction tape for outside work prepared from data furnished by tape manufacturers and also from specifications prepared by the American Telephone & Telegraph Company. The specifications were not printed in time to submit them to the various manufacturers before the convention.

DISCUSSION.

Needless to state, the report elicited a very lengthy discussion. Mr. E. F. McCabe, of Lewistown, questioned the committee on the pin recommended and the climbing space mentioned in the report, and asked if a company would be expected to change its construction every so often to meet the latest specifications.

Mr. G. E. Wendle, of Williamsport, felt that the committee had handled the question of wire crossings over steam-railroad tracks in a kid-glove fashion. The question asked in the report "Are the requirements of the various railroads reasonable?" is only the beginning of the questions which should properly be asked concerning this situation, in his estimation. A more important question is, "Do the requirements laid down for foreign wires crossing railroad tracks require construction which is more rigid than the construction employed by the railroads themselves in carrying their wires over their own rights-of-way?" Mr. Wendle felt that the present requirements were fundamentally based upon an absurd degree of safety and that the answer to the questions must, to a large extent, determine the legal standing of the contentions of the railroad companies to regulate such wire crossings and to insist upon spans, sags, tensions and general pole construction at such points. From an examination of a number of crossings constructed by railroad companies and consisting of their telegraph and telephone lines, he would seriously question the justice of the contention of the railroad companies. As a matter of fact, he said that there was no remote effort on their part to string wires and guy poles to withstand any heavy sleet storm, with the result that every storm means miles of poles and wires down. The demands made by the railroad companies on the various members of the association were, in Mr. Wendle's judgment, grossly unjust and arbitrary and not warranted by the existing construction methods of the roads in their own line work. In view of these conditions the speaker said it was advisable to determine the proper practical system of construction not only for railroad crossings, but for all parts of electric light lines. The courts demand not only good construction in overhead lines, but that it shall be made with the "highest practical degree of care." It, therefore, behooved the association to collect such a mass of data covering actual crossings erected and maintained by railroad companies that from the data thus obtained comparison can be made between the actual construction of the railroads and that demanded by them of the electric light companies. These data should be accompanied by sketches and contain the length of span, size and kind of poles, diameter and length of poles, length and size of cross-arms, methods of fastening cross-arms and wires, size and kind of wires, sag of wires under some determined weather conditions, and if possible should also contain a record of any breakdown of wires or poles. Mr. Wendle suggested that the question of railroad crossings be given over to a committee that could take up the matter with the railroad companies in the state with a view of having the matter permanently settled so that smaller companies may know exactly what construction is desired. The railroads are demanding more and more from member companies obliged to cross their tracks, and it is not expedient for the lighting company to make concessions upon concessions.

On the question of joint-pole construction Mr. Wendle maintained that, as a rule, pole-line agreements have been made satisfactorily only with the Bell Telephone Company, espe-

cially where the overhead distribution systems involved are of any considerable extent. As a general proposition Mr. Spencer's specifications (N. E. L. A. paper) form a complete and valuable document, but it was questionable to his thinking whether any small company is able in its distribution system to approach the requirements of the specifications. Much of the trouble is due to the fact that years ago the Bell company selected the upper position for its wires, while of late years the company has placed its wires below those of the lighting company. Where it is possible to reconstruct the entire system of both companies the specifications noted by Mr. Spencer would make a first-class system for joint-pole lines. In his city it is a very difficult matter to get new construction put up in accordance with the requirements of the joint-pole-line specifications without any consideration of existing work, and as the maintenance of the high-grade conditions in the original joint-pole construction is subsequently left in the hands of the linemen, it is almost impossible without excessive cost of inspection to keep the work in first-class condition and free from interference. The only way to keep up the standards of construction is by inspections thoroughly made and entered into suitable records. In Williamsport a proposition has been made to the Bell company whereby systematic inspections of all places where lines of both companies approach each other will be made by both companies, and where the lines are within less than the minimum distance agreed upon note will be made of such points in the records and whichever company is at fault must at its own expense remove the wire or wires. Wiremen guilty of infraction of orders with reference to this point will be dismissed, and it is hoped by such vigorous action that the sharp practice of some linemen will be eliminated. Mr. Wendle does not believe that any low-tension or high-tension wires should be run down a telephone pole in the open manner provided in the standard specifications of the N. E. L. A. All connections of electric light or telephone wires which are run vertically down a pole should, in his judgment, be carried through conduits of solid insulating material exclusively. To protect against accidental contacts with grounded messenger cables or other grounded telephone cables where these are below lighting wires, Mr. Wendle suggested that, in addition to the cross-arm provided for in the standard specifications, a suitable board or boxing should be secured to the cross-arm immediately above the messenger cable so that a lineman could not touch any portion of his body against either the messenger cable or aerial cable and at the same time touch one of the electric light wires above or below such telephone cable.

With reference to the clearances, sags, spans, etc., applying to wire crossings and proximities between the various independent overhead systems, Mr. Wendle pointed out that oftentimes it was impossible or inexpedient to make joint agreements. Where there are many competing companies in a town each with its pole lines, the question of proper clearances and construction is practically ignored. In view of the possible danger to life and property by reason of accidental contact between various systems of wires, the speaker asked if it were not advisable to consider carefully the question of proper specifications for all crossings and proximities for extensive overhead distribution systems. The questions to be considered and decided in such specifications are: (1) Maximum permissible length of span at the crossing or proximity; (2) minimum size of wire permissible; (3) proper sag to be given for the given span and size of wire, and (4) minimum clearance which must be given in the original construction and subsequently maintained between the separate wires at the point of crossing or proximity. A careful consideration of such points by the association would go far toward standardizing existing construction and provide against careless or reckless work in the future. The standard set by the association would receive careful attention by the courts and would probably render valueless the evidence of dishonest experts. Taking up these points in order, Mr. Wendle submitted the following: (1) At all crossings or places where close proximity will exist, the span should be short. If possible, it should be limited to 100 ft. so that No. 6 wire can be used with safety and at reasonable sags. By using such a short span the telephone companies could use properly insulated wire of moderate size to cross over electric lighting systems wherever such crossing or proximity is necessary. (2) Without question the smallest size of soft-drawn copper wire to be permitted is No. 6 for electric circuits and No. 9 hard-drawn wire with proper insulation for telephone wires or for telegraph wires. (3) On the question of proper sag there is room for considerable latitude as to the proper sag for definite stresses, but there is no question that a sag of from 3 per cent to 3.5 per cent of the span for temperatures of from 50 deg. to 70 deg. Fahr. during construction is safe. With such a sag a slight movement of poles and arms will not seriously affect the sag in the center of the span. He illustrated this point by an example from actual test on a special 25-ft. model. In addition to the actual provisions for center sag, special precautions should be taken at all wire crossings or proximities against movement of poles and arms. Whenever the poles carrying crossing wires are at bends in the line, special guying must be done to insure against movement of poles or arms due to irregular line stresses. (4) Minimum clearances between independent systems of lines at points of crossing or proximity should be at least 24 in. Mr. Wendle went into the matter of clearance at some length in order to elucidate the point made. His company has no hesitancy in saying that specifications covering proper construction and maintenance of wires at crossings and proximities backed by the Pennsylvania association and by the N. E. L. A. would have been of inestimable value in convincing the judge of the justice of his company's complaint in a recent issue before the court.

The national or state committee, he said, had not touched upon overhead line construction for parallel, co-linear pole lines, but merely dismisses the subject with the statement that it should be avoided. Unfortunately, parallel and co-linear lines are not so easily disposed of, and so far as his experience is concerned there is no legal process by which a company having a proper franchise for the erection of poles and wires can be stopped from constructing a parallel and co-linear line if it so desires, and where it is a competing company it usually so desires. He cited the development of the wire situation in Williamsport, where competing telephone and lighting companies maintained pole lines and where parallel and co-linear lines became a regular feature of the overhead construction.

In view of this and many other existing installations, he suggested that rigid specifications covering such lines be drawn up. These specifications should designate (1) the proper location of "junior" poles with reference to the existing "senior" poles and lines; (2) the minimum clearance to be obtained between the lowest wires of the junior company above the line of the highest cross-arm of the senior company; (3) the minimum difference which is permissible between the length of spans of the junior company and the length of spans of the senior company; (4) the sags to be placed in such junior lines; (5) the duty of the junior company in regard to the protection of the wires of the senior company where the poles pass through such wires. Under the last head it should be determined whether it is the duty of the junior company to provide standard cross-arms on its poles and to which cross-arm the wires of the junior company shall be attached so that the position of its poles in the wires of the senior company is practically maintained. Also, in case changes must be made or work done on the lines of the senior company in order properly to construct the junior line, whether the junior party shall be at the total expense of such necessary changes or work. (6) In all work submitted by the various overhead line committees particular attention has been paid to the original construction, and anybody following the specifications and suggestions of the committee cannot but secure thoroughly first-class construction. After the original construction is done some obligation rests upon companies to inspect and maintain the system to some standard.

In all accident cases which have been decided upon by the courts the language of the decision invariably implies responsibility for proper or adequate inspection and it further requires that not only shall pole lines be constructed, but that they shall also be "maintained with the highest practicable degree of care." This is a very broad standard of electric light companies' duties and as the court has not any standard upon which to base opinion, the question of the adequacy of inspection, according to Mr. Wendle, is usually left to the jury and the electric light companies foot the bills. He maintained, therefore, that it was time for the practical operating men in the lighting business to formulate safe and reasonable specifications or regulations governing this portion of the work, so that such regulations can be submitted to the court in cases where inspection and maintenance questions are involved, and in case experts are called that their testimony must be largely confirmatory of the regulations formulated by the association. Such specifications must have positive influence with judges and juries.

A representative of the Bell Telephone Company of Pennsylvania outlined as one of the advantages of employing standard specifications for overhead line work the possibility of quick transfer of material, in case of emergency, between properties in various parts of the country. On the question of joint pole lines he said the Bell companies were willing to meet the electric light companies half way under ordinary conditions. Voltages of 5000 and over on constant-potential systems are feared by telephone managers because of their possible effect on the service. A cross at this potential may mean, besides the risk to human life, a fire whose destructive effect, while large, is small compared with its effect on the company's service and patrons. The company on the other hand does not object to joint occupancy with constant-current systems having potentials not higher than 10,000 volts, provided the current is not over 7.5 amp. The speaker cited two systems that cause induction troubles on long-distance telephone lines, namely, a three-phase, star-connected system with grounded neutral and a single-phase railway system.

Mr. E. B. Greene, of Altoona, took exception to the statement of the committee that lightning arresters were not dependable and also to the method of grounding to pipes. He said telephone companies could hardly expect to get good service out of their lines in close proximity to a star-connected grounded three-phase system unless the grounds were well made with copper and coke somewhat after the fashion recommended by the fire underwriters in the National Electrical Code. His company's transmission line, which is 80 miles long, gave telephone companies trouble; but when the type of ground specified was installed no further complaint was heard. Prior to that time also it was necessary during thunderstorms for two men to be stationed at the circuit-breakers to keep them closed; but since the change of ground no breakers have come out during such storms, nor have any transformers been lost.

It developed in the discussion that the Public Service Corporation of New Jersey has an excellent system of keeping pole-line records and that Washington, D. C., possesses good specifications for joint-pole lines, etc. For the purchase of material it was admitted that the specifications of the American Telephone & Telegraph Company are excellent.

Mr. A. R. Granger, of Chester, agreed with Mr. Wendle on the necessity of some standard construction for railroad crossings and also felt that joint-pole lines were advantageous in many localities. He cited an instance where a company exercised the right of eminent domain where permission to erect poles was refused and desired to know if any member companies had ever resorted to this right.

### CENTRAL-STATION STEAM HEATING.

A paper entitled "The Development and Application of Central-Station Heating," by Mr. C. R. Bishop, of the American District Steam Heating Company, of Lockport, N. Y., was then read by its author. Mr. Bishop referred to the fact that Pennsylvania possesses a greater number of cities having district heating service than any other State and could also lay claim to the greatest or most extensive steam-distribution system in existence. He compared the heating systems of the early and present periods and said that operating reports of companies keeping accurate records prove that transmission losses in a properly constructed and well-insulated steam main are very low. The loss, he claimed, is constant whether only 5 per cent or 100 per cent of capacity is being transmitted, and that the amount of condensation per square foot of steam main surface is increased or decreased directly in proportion to the degree of perfection of the insulation. He then outlined the requisites of a good system. That district steam heating is profitable, he claimed, is shown by the fact that in Pennsylvania there are more companies operating central heating plants exclusively than there are companies operating both electric and steam plants and utilizing the exhaust for commercial heating purposes. At present there are twenty-two companies in the State engaged in the distribution and sale of electricity and exhaust steam and the growth is in favor of combination plants. Comparing the results of a company operating a combination electric and steam heating plant for three successive years, the author gives the following data:

| | 1906–1907 | 1907–1908 | 1908–1909 |
|---|---|---|---|
| Fuel burned during heating season, lb.. | 32,032,000 | 28,311,830 | 28,376,600 |
| Electricity generated, kw-hours..... | 2,336,766 | 3,803,039 | 4,368,100 |
| Steam receipts..... | $51,785.23 | $59,355.16 | $65,972.52 |
| Cost of fuel, water, labor and supplies... | $48,174.48 | $43,391.40 | $44,178.90 |

Many combination plants operating in towns of less than 3000 inhabitants are deriving satisfactory profits upon investments in heating plants also. The author pointed out that if a district steam heating plant is operated in connection with an electric light or railway plant very little, if any, additional power-house equipment is required and no additional power-house employees unless the electric operation is not on a basis of twenty-four-hour service. Companies not operating a day electric circuit find that the addition of steam heating utilizes profitably their investment in boiler plant for a much greater number of hours and further assists in increasing the load factor at the plant with resulting increase in boiler economy.

The verbal report of the committee on steam heating in connection with central stations was then presented by the chairman, Mr. M. J. Fogarty, of the Erie Company, Erie. Nothing of moment occurred in the steam-heating field during the year, so the committee had nothing new to offer other than the paper of Mr. Bishop, which was prepared at its suggestion.

#### DISCUSSION.

Messrs. E. J. Kiefer, of Easton; R. L. Lloyd, of Philadelphia, and G. E. Wendle of Williamsport, questioned the author on certain points, such as line losses, method of charging, reliability of meter, overhead charges in a steam-heating system and meter rate where coal costs from $2 to $2.25 per ton. Mr. Bishop in replying to these said that the line losses vary from an average of 0.046 lb. to 0.043 lb. per square foot per hour. Steam meters in New York are tested by the Public Service Commission and the percentage of error ranges from 4 per cent to 0, depending on the load. He said that steam meters should be tested yearly in summer and in any case should be oiled and cleaned. This work can be done in summer by the meter reader. Flat rates show higher fuel consumption in the station than meter rates and with less heating. Where steam is sold by meter the radiators are shut off in warm weather rather than the windows opened to effect the necessary decrease in heat. The rate should be high enough even where meters are installed to bring about the economical use of the heat. The rate where coal is worth $2.25 per ton, he said, should range about 60 cents per 1000 lb. of condensation.

### RELATIONS WITH N. E. L. A.

Thursday's session was opened with an address by Mr. W. W. Freeman, of Brooklyn, president of the National Electric Light Association, who, with Mr. T. C. Martin, secretary of the association arrived the night before from the convention of the New England N. E. L. A. Section. Mr. Freeman stated that the officers of the N. E. L. A. would bend all their energies this year toward the upbuilding of a strong national body and would make a special effort to enroll the small electric light companies—not because of any financial benefit, but because of the prestige and influence they would give to the organization in making it truly representative of the entire electrical industry. In this work much reliance would be placed on the state organizations. He hoped also that the testimony of the existing state branches would be instrumental in bringing additional geographical sections into the national body. The difficulty lay in convincing present state organizations outside the national body that merging with the national would not mean loss of identity or curtailment of privileges, but rather a larger field of operation and greater benefits. Many state organizations also included in their membership municipal plants, and inasmuch as the operation of such stations is essentially at variance with and antagonistic to private enterprises as represented in the membership of the N. E. L. A., merging was impossible until the municipal plants were dropped. This was another stumbling block which must be overcome. Mr. Freeman outlined the scope of work which state organizations can best do and said the best results are obtained by a co-ordination of local organizations into the national body.

Mr. T. C. Martin followed Mr. Freeman in an address giving statistical data of the national body and announcing that the Nebraska association has applied for membership and was now affiliated with the national body and that the Georgia association was also expected to join with the national body this fall. The N. E. L. A. he said was fast assuming a federal basis and composition, and state bodies would eventually rule and dominate the organization. He referred to the "Question Box," "Solicitor's Handbook," and the classification of accounts, advising all Class A members to follow the system, so that good results might be obtained from a comparison of accounts of various stations and interchange of data compiled according to the same system. He also pointed out the advantages of company sections to the stations themselves in having employees actively interested in the work.

### CENTRAL-STATION OPERATION.

Mr. T. G. Coghlan, of Scranton, then presented his paper, entitled "Advantageous Points in Central-Station Operation," in which he touched briefly on some essential points in power plant work. The total boiler-room cost per kw-hour generated, he said, was the best comparison of the commercial efficiency of different fuels. The men employed in the boiler-room should be specially fitted to become skilled attendants, and to this end should be systematically trained. The boiler-room, he maintained, is the point of greatest waste and yet no other department exercises so little care in the employment of men. The remuneration should be sufficient to attract good men, because cheap labor in the boiler-room is the most expensive help a station can have. Mr. Coghlan emphasized the necessity of a complete system of boiler-room and engine-room records and said that unless the system was adequate a manager could not know just what the station is doing all the time, and if any change in the economy of operation occurs cannot trace the cause and take advantage of it. He outlined a system of records which he thought should suffice and though it might be thought by some to be rather complex and require high-class engineering skill to ascertain the various data, he said it was, in fact, simple to carry out. Efficiency, he claimed, cannot be maintained by guesswork, and an Orsat apparatus in the boiler-room for testing flue gases was just as necessary to an engineer as a steam-engine indicator. The first saves the company dollars, while the second merely saves dimes. Bright fires, clear stacks, good cards, absence of leaks, etc., do not always indicate economical operation, because a million heat units might be wasted heating excess air and the plant be more of a "hot-air factory" than an electric generating station. He also outlined the requirements of a good engine-room log book.

Various other points, such as the inspection and cleaning of boilers, treatment of feed water, repairs to brickwork, baffles and fittings, inspection of valves, engines, etc. were touched upon and their importance accentuated. The author pointed out that it is not the amount of oil used in lubrication that costs, but the amount wasted. The oil should be extracted from waste used in wiping and cleaning, filtered and again used, while the waste itself should be put in a tank and thoroughly boiled out, after which it should be passed through a ringer and placed on a drying rack. The advantage of cleanliness, not only with reference to its effect on the station employees, but also on the life of the apparatus, was pointed out, as well as the desirability of equipping all apparatus with safety appliances and safeguards. The last point touched upon was the building up and maintaining of a thoroughly efficient and reliable organization of men running the plant, from the ash men to the engineer; and as the organization as a whole depends upon each individual, care should be taken in the selection of men and in their training. The author finds that in central-station practice it is necessary to develop the talent and to employ only such men as can be improved and advanced. Reliability in men, he said, is brought about by a knowledge of the confidence of their superiors and increased and strengthened by their superiors' confidence in them.

#### DISCUSSION.

Mr. R. S. Orr, of Pittsburgh, took exception to the chemical method recommended of purifying feed water for boiler purposes as being too costly. He said it was cheaper to allow deposits to take place in boilers and to remove them from time to time mechanically. The expensive systems usually installed do not remove all impurities and the deposit which forms must afterward be removed anyway. The scale can be chipped or knocked from a boiler mechanically at a cost which is less than the interest and depreciation on an elaborate chemical system. Any acid in water, however should be first neutralized by the addition of soda or barium hydrate.

Mr. J. S. Wise, of Hazleton, said that it would depend on local conditions whether the water should be purified before it went into the boiler or whether the scale should be allowed to accumulate and be finally removed mechanically. He himself uses a compound which causes the scale-forming ingredients to collect in the shape of a soft mud which is easily blown out.

Mr. E. L. Franklin, of Easton, said that the apparatus and system suggested in Mr. Coghlan's paper were too costly for small stations. Moreover, to be of any benefit, the data so collected would have to be studied, and this required time. Where the station has a small output, the advantage of an elaborate system calling for expensive testing apparatus was questionable. In his station the purification of water does not entail much labor, since surface condensers are employed in connection with steam turbines so that such troubles are minimized. He felt, however, that the logical way to get rid of scale was to nullify its effects before it got into the boiler, and not after. It took time to scale a boiler, and the loss of the services of the boiler was an item of moment, not to mention the loss incurred while the scale is forming. In Pennsylvania, he said, he noticed that scale formed very quickly at certain seasons and not at all at other seasons. This he attributed to rains and droughts. On this account he claimed that the feed water should be analyzed weekly and the compound changed to meet the changed conditions. The analysis of flue gases, he said was important because a loss of 1 per cent meant that $3.50 per month might be profitably added to the wages of a fireman who could eliminate the loss. Many plants have losses far greater than 1 per cent, however. He said that the trend of practice is to design furnaces to burn the coal and boilers to utilize the heat to best advantage. He called attention to the advantages of the "Dutch Oven" furnace and also to the advantages of cleanliness in the engine-room and boiler-room of a station.

### NEW TYPES OF LAMPS.

The second paper at Thursday's session was prepared and read by Mr. G. E. Brett, of Wilkes-Barre. Its title was "New Types of Lamps from the Operating Standpoint" and it was prefaced by a brief history of the developments in electric lighting down to the advent of the flaming arc and tungsten incandescent lamps. The flaming-arc lamp, while attractive to the general consumer, he said, did not prove to be as successful from an operating point of view as might have been supposed, due primarily to the short life of the electrodes and the low voltage of the arc. While the light was of unusual value commercially, it was questionable, where the central station had many lamps to maintain, whether the advantages gained in illumination were sufficient to compensate for the additional expense required in operating the lamps. The series-luminous arc lamp, he said, opened up a very large field which operating companies were not slow in seeing and taking advantage of. The 4-amp magnetite lamp consuming 320 watts as against 480 watts in both the alternating-current and direct-current, series enclosed arc lamps also showed a gain in lighting distance of from 60 ft. to 100 ft., both lamps being at the same height. The luminous-arc lamp, he claimed, is being largely used for street lighting with very satisfactory results and is destined to be widely employed. From the operating point of view it is a question in the minds of some engineers as to the current value to be established for the most satisfactory results. Some feel that it would be better to give a higher current consumption, thereby increasing the standard of illumination, and it is proved that where it is possible to do so it is better to give the consumer the increased illumination at practically the same price than to decrease it in proportion to the standard in vogue at present. In operating arc-lighting systems one primary reason advanced against the increased current consumption is that leaks showing up on small current systems have a tendency to increase operating troubles very materially. While it is true according to the author that the lower ampere system can be constructed and operated at less cost, it is very questionable whether this is altogether as safe, as the smaller size of wire which can be employed with less current has less tensile strength. Therefore, it would be more liable to damage and destruction from sleet and wind storms, which are the operators' greatest troubles. The higher amperage luminous arc both from an operating and commercial point of view he believed to be far more satisfactory for a street-lighting system than any so far devised. There is nothing more pleasing to either municipal or individual consumers than to show them in a practical way that they are getting twice the amount of illumination without additional expense. Coming to the tungsten lamp the author felt that its use in street lighting is fast coming to the front, and that it will in congested districts eventually supplant the arc lamp system. The standard multiple tungsten lamp has, however, not proved very satisfactory for outdoor lighting thus far, due to vibration causing excessive breakage. As a more satisfactory solution, the lower voltage lamps may be employed and run in multiple series. He then described the method of hanging these lamps as employed in Wilkes-Barre, which scheme has been illustrated and described in these columns some time ago. Regarding what part of the thoroughfare should be lighted, the author stated that according to some the lamps should throw the light into store windows, according to others on the sidewalk alone, while others maintain they should light the street proper. The author said it was none of these singly, but all of them together; in other words, the entire vista. His company found after repeated experiments that the center of radial illumination, where posts are employed, should be from 12 ft. to 14 ft. above the sidewalk. If the lamps are lower the light will shine in the eyes of the pedestrian, and if higher the illumination will not be strong enough. It has been found that a cluster of five globes, four 12 in. in diameter and one 16 in., each fitted with the most approved 100-watt tungsten, will give more light for less money than any other scheme. The standards may be placed 75 ft. to 100 ft. apart to eliminate dark spots. The author next discussed the choice of suitable posts which were not over-ornamental, and followed this by references to the tungsten sign lamp situation. He said a tungsten lamp was better for a sign than the old carbon-filament lamp, in addition to being less costly to operate.

#### DISCUSSION.

It was pointed out by a few of the speakers that the tungsten lamp has a tendency to over-illuminate, because customers substituted a large, clear-bulb tungsten for the ordinary 16-cp carbon lamp. Mr. H. N. Muller, of Pittsburgh, said that this could not be prevented at present unless lower voltages obtained. He said that the W-filament in tungsten sign lamps, to which reference was made, has, owing to the numerous points of support, been abandoned by the manufacturers in favor of the V-shaped filament, the latter being more practical.

Mr. Cooper, of the National Electric Lamp Association, said that the point brought out by Mr. Brett, that it was the entire vista which should be illuminated by the posts, expressed the situation exactly. Moreover, the tungsten street lamp was also applicable to outlying and suburban districts as well as in congested districts. The spacing of the posts and their height would depend on the width of the street, very wide streets requiring posts higher than was stated in the paper.

Mr. G. H. Stickney, of the General Electric Company, said that the new lamp brought with it new problems which some stations tried to avoid, but which, as it is impossible to do so entirely, must be controlled. The new units should be installed so that they would be a benefit to the station and consumer alike. He cited the new developments in arc and incandescent lamp fields both of which have run side by side. In some cases these lamps have been placed on a competitive basis and in others on a complementary basis. The arc lamp is better in some cases than the incandescent lamp, and vice versa. Central station men, he said, should understand the characteristics of both and adapt them to their needs.

Then followed a long and animated discussion regarding the tungsten lamp in connection with gas and gasoline lamps. Messrs. W. W. McCleary, of Pittsburgh; W. C. Anderson, of Plymouth; E. F. McCabe, of Lewistown; F. S. Nicholson, of Sayre; G. H. Stickney, of Schenectady; W. W. Freeman, of Brooklyn, and others joined in the discussion, which was afterwards expunged from the records by vote, owing to the information it might afford to the gas interests in acquainting them with the shortcomings of their product and apparatus.

### OPERATION OF ELECTRIC VEHICLES.

The last paper at Thursday's session was prepared by Mr. W. A. Manwaring, of Philadelphia, and in his absence was read by the secretary, Mr. Van Dusen Rickert. It was entitled "Operation of Electric Vehicles," and pointed out the advantages of the electric over the horse-drawn vehicle. Many data worked out from records of vehicles, batteries and tires used in an electric light company's service were included as being of interest to those considering the adoption of the electric vehicles. These vehicles, the author stated, were purchased in 1905 and 1908, and could not be compared with the more modern vehicles of to-day. In concluding his paper the author emphasized the fact that the most important point in the maintenance and operation of the electric vehicle is the proper care of the batteries. Where batteries are looked after, he said, there was no trouble in proving that the electric was far superior to the horse-drawn vehicle.

#### DISCUSSION.

Mr. W. W. White, of the Philadelphia office of the General Vehicle Company, in opening the discussion, pointed out wherein the modern vehicle surpassed in every respect the vehicles mentioned in the paper from which the data were obtained. His company's product, he said, was standardized and was guaranteed. A thin-plate battery is now used which possesses a greater output per pound and a larger overload capacity. The renewals are guaranteed not to cost above a certain sum, and the cars are regularly inspected.

Mr. R. L. Lloyd, of the Philadelphia Electric Company, referred to the recent run of commercial vehicles between Phila-

delphia and Atlantic City, an account of which, with statistical data of performances, appeared in these columns at the time, and cited the case of a Baker vehicle equipped with Edison batteries which made a run of over 200 miles on a single charge.

Mr. E. F. McCabe asked for information concerning the comparative overhead charges of electric and gasoline vehicles, and Mr. White answered that the depreciation was less in an electric than in a gasoline car; the tires lasted longer because of the better acceleration of the electric, the maintenance was less, and altogether the gasoline car could not approach the electric vehicle for general city commercial work. Mr. White also answered questions of Mr. Wendle, of Williamsport.

### COMMERCIAL DAY.

Friday was set aside as "Commercial Day," with Mr. D. T. Campbell, of Scranton, presiding. The first paper presented was written by Mr. H. M. Blake, of Jenkintown; Messrs. W. R. Power, of Tyrone; A. H. S. Cantlin, of Allentown; E. H. Davis, of Williamsport, and F. M. Noecker, of Renovo, collaborating. The paper was read by Mr. Granger.

### INVESTMENT JUSTIFIED BY SMALLER COMPANIES FOR SECURING POWER BUSINESS.

In this paper Mr. Blake assumed that the subject is intended to cover the permanent investment in generating and distribution equipment and not the expenditure for soliciting, engineering services, etc., incident to securing business, which expense is chargeable to operation. The question applies equally to large companies as well as to small ones; that is, that the investment justified depends entirely upon the rate of interest desired and as to whether each particular situation will give this return or not, which in turn depends on the price to be charged for energy and also to the load and distribution factor. The author is of the opinion that the value of power business has been much overestimated by most managers under the assumption that power business is off-peak business, and therefore the returns from this business should only cover interest and depreciation on the investment directly necessary to take on this particular business plus the bare manufacturing cost of energy. This reasoning is correct as applied to certain specific lines of business where the station management can control the situation, such as in supplying power for municipal water works or for business confined to the summer months. Another theory advanced by some managers is that the cost of new extensions should be paid for in two years. This plan was advocated at last year's convention; but the author cannot see, however, on what reasoning such a rule could be based or why it should apply to a small company and not to a large one, except that perhaps the large company would have more opportunity to make use of the investment for other consumers in case the business originally acquired should prove unsuccessful. An investment, then, would not be justified by a small company if the business for which the investment was made was uncertain, or where a long-term contract could not be secured, or if no other business could be secured in the district in case the business for which the investment was made should fail. In the event of a fairly long-time contract (say five years) not being renewed, the company would still be justified in making the investment, as at the end of the contract term sufficient other business should have developed along the extension to pay interest on the investment.

Aside from the special cases of off-peak business above referred to, all business taken on by any company should be made to cover its proportion of plant investment and other fixed charges. According to the author, the theory of making low power rates to ten-hour consumers is not correct, as there are very few instances where such consumers do not overlap the load peak during the winter months, and therefore this should be classed as peak business. Mr. Blake said that a moderate-sized station in a city of 25,000 inhabitants, having a maximum load of 500 kw and a load factor of 25 per cent, would, with sufficient reserve apparatus and a well-constructed distribution system, cost approximately $500 per kilowatt; but, as many stations of this character grew on the instalment plan and made some costly mistakes, the actual investment would be nearer $750 per kilowatt. Before making any expenditure to take on new business 8 per cent of $500 cost should be allowed for depreciation, plus 6 per cent on $750 investment, or $85 per annum per kilowatt of station capacity. The station load being roughly 25 per cent of customer's maximum load, $21.25 per kilowatt demanded should be received to warrant the station in taking on business at all. On an operating basis of 10 hours a day or 54 hours a week the fixed charge would be ¾ cent a kw-hour; for 5 hours a day, 1½ cents, and for 1 hour a day, 7½ cents per kw-hour. This is in addition to the interest and depreciation on the extension necessary to take on the business and the cost of manufacturing energy. Thus the investment justified depends almost entirely on the length of hours of operation or load factor and the price which may be obtained for delivered energy. In supplanting isolated or competing plant service part of the cost of replacing one type of motor by another must also be met, so that with small companies an extremely high load factor or high rates are necessary conditions for taking on the motor load. The author maintains that investments made to protect present business against competing plants or isolated plants can be justified even without any immediate financial returns.

In estimating allowable investment based on prospective returns Mr. Blake says one very important fact must not be lost sight of. The improvement in the station load factor due to the increased motor load will in most instances result in decreasing the kw-hour operating expense for all energy sold and thus increase the station net earnings materially even though the motor-load is taken on at bare cost.

In considering the investment justified the author finds a number of the smaller companies have a tendency toward supplying two-phase or three-phase service with its multiplicity of lines, transformers and meters to small motors where single-phase service would answer the purpose quite as well. Roughly speaking, no company of the size above referred to should supply anything but single-phase service for motors smaller than 5 hp unless the customer is willing to guarantee the same minimum guarantee that would be expected of a 5-hp motor. After considering business requiring investment, he says, it must not be forgotten that a large amount of business can be got on the existing circuits without any additional investment whatever, such as coffee mills, dough mixers, ice-cream freezers, fan motors, dental motors, sewing-machine and washing-machine motors, flatirons and cooking utensils. This class of business is being overshadowed by the enthusiasm to secure larger power business whereas in reality it should receive first consideration.

#### DISCUSSION.

Mr. E. F. McCabe agreed with the author that any investment justified by a small company is also justified by a large company. The expense for acquiring a motor load, the returns from which would offset the investment in two or even more years, is justifiable. He did not agree with the author on the undesirability of much ten-hour business and said that any business that would increase the station-load factor without lowering the power factor should be encouraged by a low rate. Five hundred dollars per kilowatt for average stations and $750 for old stations, he claimed, was too high and had nothing to do with the question anyway. Customers should not have to pay for dead wood; a turbine station can be installed at a cost of about $75 per kilowatt and a plant with reciprocating engines for about $125 per kilowatt. He felt that in many instances distribution costs could be reduced by installing high-tension motors. The power-factor of the system could also be improved by the installation of group drives rather than of small individual motors. In the case of direct-current motors fed from an alternating-current station, he suggested that instead of replacing the motors with alternating-current machines, a synchronous motor-generator set be installed. The motor could be made large enough to bring up the power-factor of the system.

Mr. E. H. Davis, of Williamsport, wanted to know what proportion of gross receipts could be expected of motor customers in an ordinarily well-managed station. He also wished to find out how isolated plant business was acquired and how much a company could afford to spend to acquire such a load. Mr. Hubbell, of Carbondale, said his company receives about 15 per cent of its gross income from motor customers. Mr. F. Woodring, of Titusville, said his company receives from 30 to 35 per cent of its gross revenue from motor customers and had only been acquiring a motor load one year. In this his company was greatly assisted by the motor manufacturers. The average return from group drives is $35 per hp-year and from $12 to $15 from individual drives. His company displaced gas engines and has a standing offer of $150 for every 35-hp engine taken in exchange for electric motors. His company, operating in an oil country, finds a ready market for these old engines. Mr. F. M. Nocker, of Renovo, said the motor business of his company represented about 30 per cent of its gross revenue, the figure included municipal lighting also. On some motors the return varies from $60 to $75 per hp-year and many yield a revenue of from $40 to $60 per hp-year.

Mr. W. A. Donkin, of Pittsburgh, said his company had to pay more than $150 for a 35-hp gas engine. In such cases the company must make the best deal possible under the circumstances. His company had displaced a 400-hp steam plant which fed about 350-hp in motors. It allowed $2,000 for the apparatus in energy and considered it a good investment, the guaranteed consumption on a five-year contract being $6,000 per annum.

Mr. E. F. McCabe said that in his territory customers have told him that they paid less for energy than for the repairs on gas engines. Mr. W. A. Donkin said there are good and bad gas engines and cited a case where he displaced a gas engine by an electric motor, and although the service was more reliable the gas engine won out in the end on low cost of operation.

Mr. Lloyd, of Philadelphia, said an answer to Mr. Davis' question would depend on the locality of a station, stating that in his district the lighting load yielded the entire income.

Mr. E. B. Greene, of Altoona, answered in a like manner. In manufacturing communities the motor load might represent 75 per cent of the station's gross income. In Altoona, where water is brought in cars 100 days of the year and where at such times the water costs more than the station is able to earn, a motor load could hardly be expected. Nevertheless, his company had succeeded in acquiring a load the income from which represented 15 per cent of the gross earnings.

Mr. E. F. McCabe pointed out the advantages of an instrument which would indicate the maximum demand of a motor installation in apparent power much like the Wright demand meter used for lighting installations, and asked if any member companies had or knew of such a device. The graphic meters, he said, were too expensive. Mr. Richardson, of the General Electric Company, said his company builds a maximum power indicator, which measured true watts; but this is not a cheap instrument.

Mr. E. H. Davis wanted to know what rate member companies held isolated plant business on. He said his company had a maximum rate for such loads which was low; but it found difficulty in holding the business even at from 2½ to 2 cents per kw-hour.

Mr. W. A. Donkin took exception to the statement of the author that the theory of the ten-hour service is not correct. Only from 5 to 10 per cent of his company's motor load comes on the evening peak and it has 20,000 hp connected. He is certain his company can take ten-hour business at a very low rate and earn money. Ninety per cent of his company's non-peak load is in reality non-peak. Messrs. McCabe and Granger spoke of morning peaks which some stations had.

Mr. E. L. Franklin said that peaks should have careful attention. The peak shifts with the motor load in Easton and as more business is acquired the peak will eventually come in the afternoon rather than in the evening. The ultimate development in the power business will make what are now valleys, peaks, he thinks. Mr. Donkin believes that the peak will always manifest itself in the evening, but that peaks are no longer feared. For some years managers used to worry about how they would carry the Christmas load, but as they increased their motor loads it seems that the Christmas peak question disappeared. The only question in Mr. Blake's paper that needed solution, he said, is "How much can a small station afford to pay per kilowatt of load?"

Mr. Granger recalled the speech of Mr. Samuel Insull, of Chicago, in which he referred to off-peak business afforded by water works and gave his experience in hurrying from Atlantic City to acquire the pumping load in his city only to find that new engines were ordered for the pumping plant while he was at the seashore. Mr. Orr doubted if fixed charges should be made against motor business which is off-peak. Mr. Lewis, of Scranton, gave his experience in trying to displace a gas engine in a stone yard by an electric motor without success because of the monthly minimum charge.

### DOMESTIC APPLIANCES.

A paper with this title was next presented by Mr. W. A. Donkin, of the Allegheny County Light Company, of Pittsburgh, who said that in the frantic effort to acquire motor loads many stations had overlooked the possibilities for increasing the revenue from existing installations through small domestic appliances. A 450-watt iron, for instance, yields a revenue of $1 a month and there are very few stations having day circuits which could not easily place 100 irons. The author divided domestic appliances into two classes, those which may be operated from lamp circuits and those requiring a separate circuit, and limited his paper to those in common use. The electric iron, he claims, is unquestionably the best revenue producer of the small appliances, and the general conditions covering its introduction, sale and maintenance apply to the many other appliances manufactured for domestic use. In discussing the methods employed the author said his company found, particularly in the natural gas territory, that the use of an electric iron by a new customer unfamiliar with its operation, together with the naturally excessive use of light during the first month, runs up such a bill as usually to result in his abandoning the use of the iron, forever being antagonistic to the use of other electrical appliances and also curtailing the use of energy for lamps. His company bills the iron after a thirty-day or sixty-day trial and during 1909 placed 2069 irons, over half of which were retained and paid for. Realizing that the price asked for a good portable vacuum cleaner, $125 to $150, is more than could be expected of the average customer, the Allegheny County Light Company organized a rental cleaning department and purchased twenty-five machines, which were rented at $2 a day delivered. The company now has 100 vacuum cleaners in use, the revenue from which is large. Operating in a territory with natural gas selling at 27½ cents per 1000 cu. ft. all reference to the cheapness of electric heating is avoided while the other qualities are accentuated. The company hopes to compete with natural gas as soon as a reliable electric fireless cooker appears. The maintenance of these domestic appliances in proper operating condition after installation is one of the most important features of this branch of the service, otherwise a slight defect will lead to the abandonment of the device. Mr. Donkin called attention to the need of a better arrangement of interior wiring for domestic appliances to overcome the unsightly flexible cord dropping from a handsome dome in the dining-room, for instance. He said that advertising unquestionably increases the sale of domestic appliances, although direct results cannot be estimated. The sales of domestic appliances by his company in 1908 doubled the sales of 1907, while in 1909 the increase was 17 per cent over the previous year. During the seven months of 1910 the sales amounted to double the entire sales of 1909. The author also included papers by Messrs James E. Pyle and Thomas C. Walsh.

DISCUSSION.

Mr. E. B. Greene said that sixty days was too long a time to have an iron on trial and that in Altoona the time had been reduced to fourteen days. A double card system is employed, a card being left with the iron by the solicitor, who calls the next week and writes on the cards the remarks of the housewife. Ninety-seven per cent of the irons sent out were sold and with less than 3000 residences wired there are 2460 irons in use. The load on Tuesdays is 400 kw in excess of other days and comes on after breakfast and lasts until about 4:30 in the afternoon with a drop in the curve from 11:45 a. m. to 1:30 p. m. The business from domestic appliances, he said, is permanent if customers understand the use of the devices and these in turn suit the home hibit. In answer to a question of Mr. Davis, Mr. Greene said that it cost the company 50 cents to introduce an iron, not counting delivery.

Mr. Wendle cited the experience of his company in Williamsport with the electric flatiron, stating that his company had acquired a liberal education while the manufacturers received all the money. It was felt at first that 75 cents or $1 would cover the expense of introducing the iron; but the company found that it would have been cheaper for it to have given the irons away. At present a high-school boy is employed on salary and commission to introduce the irons. The speaker agreed with Mr. Greene that fourteen days was sufficient time for trial. When his company allowed sixty days it was necessary to carry a large stock of irons. He said he noticed that when stores gave things away there was always a rush of people, so he tried a scheme of getting a customer to pay $4 for an iron and giving him a receipt calling for a credit of $1 on any electric light bill, which plan met with remarkable results. Irons sold by contractors were also accompanied by credit receipts. The main point about electric irons, he said, is to get them used.

Mr. McPherson, of Easton, said that the revenue received from the use of irons could not be determined accurately. As to the expense of introducing them, he claimed, there should be none since a good salesman would dispose of them with profit to the company and himself. He did not believe in spending the revenue from a two-years' use of a device in introducing it.

Mr. Hubbell, of Carbondale, asked concerning the repairing of irons and many vouchsafed the information that the usual method is to charge the cost of the material and labor. The rates for energy in Altoona, Mr. Greene said, are 8 cents for the first 26 kw-hours and 4 cents for all energy in excess of that amount, which gives irons a 4-cent rate. The rate for energy at Williamsport is 10 cents for the first 15 kw-hours and half that amount for all in excess. Mr. Orr cited some instances where the desire for electric domestic appliances was the sole cause for the introduction of electricity in a number of residences in the Pittsburgh territory.

ELECTION OF OFFICERS.

After the discussion on Mr. Donkin's paper and before the reading of the paper on "Rates" the association went into executive session. When the routine business was transacted the report of the nominating committee was presented and acted upon with the following result: President, Mr. A. R. Granger, of Chester; vice-president, Mr. R. S. Orr, of Pittsburgh; secretary and treasurer, Mr. Van Dusen Rickert, of Pottsville; additional members of executive committee, Messrs. M. J. Fogarty, of Erie; W. C. Anderson, of Plymouth, and F. M. Noecker, of Renovo.

Mr. Albert R. Granger, the president-elect of the Pennsylvania Electric Association, was born in Philadelphia, April 1, 1875. In 1891 he entered the employ of the Edison Electric Light Company, of Philadelphia, and in the successive merging of the various electric undertakings in the Quaker City he was made superintendent of the Wissahickon Electric Light Company and later manager of the Diamond Electric Company. He afterwards became manager of the Beacon Light Company, of Chester, Pa., and in addition has recently been made vice-president and general manager of the Delaware County Electric Company, both of the latter companies being controlled by the Philadelphia Electric Company. His experience for the past twenty years with both the largest and some of the smallest companies in the State has particularly fitted him for the office of president of the association. Mr. Granger through the Beacon Light Company was one of the charter members

President-Elect A. B. Granger.

of the Pennsylvania Electric Association and has served on the executive committee since its inception and during the past year as vice-president. He is identified prominently with all the local electrical organizations and is a member of the Lee Lee Temple, Oasis of Philadelphia.

RATES.

The paper prepared on this topic by Mr. L. H. Conklin, of Pottsville, was read in his absence by Mr. H. G. Glass. The author frankly admits that the question of rates has resulted in a great diversity of opinion and that each man rides his own hobby to his heart's content. He presented some arguments in favor of a more concerted and thorough study of the question by the Pennsylvania association in the hope of starting united action. The author referred to Mr. Doane's paper before the St. Louis convention of the N. E. L. A. as showing the interest in the subject and the necessity of facing the problem presented by the introduction of the tungsten lamp. If stations recoup their losses, due to existing customers changing to the new lamp, simply by the addition of new business as fast as existing revenue is decreased, they simply lessen the possibility of greater profits to come, and mortgage the future to tide over the present. The central station, he said, ought not be made to bear the whole burden of the saving made possible by the use of the tungsten lamp. One might think that the tungsten lamp has opened up possibilities for new business not otherwise attainable, when in reality it may have caused him to put forth greater endeavors to get business where before he believed it did not exist. The author feared that under many rates schemes, losses will eventually occur, since it does not alter the facts if they are made up by profits on other classes of business. The situation at present is that the manufacturer is making a good profit on his lamps; the customer is saving on his bills, while the central station is forced to struggle harder to keep abreast of this progress. There is no sane reason, the author said, for penalizing new and profitable business with the loss on the old. He said the so-called three-rate scheme (that outlined in Mr. Doane's paper) is the one that is doubtless nearest correct, consisting as it does of a customer's charge, a demand charge and an output charge. He said, however there were commercial difficulties in the way of a three-rate scheme that cannot be overlooked. The demand and customer's charge can very well be combined, he believes, for the transition period at least, thus

making the demand charge based on candle-power and the output charge on kw-hours. He then outlined a rate scheme of this kind which has been adopted in a city of 90,000 people where competitive conditions prevail. The scheme is based on a charge of ¾ cent per month per candle-power of the demand, plus 3.5 cents per kw-hour for the energy consumed. For motor circuits the rate consists of a charge per kw-hour depending on the hours' use per month of the demand. This determines the gross rate, which as based upon the load factor, and the bill is subject to discounts depending on its amount.

DISCUSSION.

That the subject of rates is a very live one and uppermost in the minds of many central-station men is evident by the animated discussion which followed the reading of the paper and which continued long after the hour set for adjournment, and even then had to be cut short abruptly. Mr. Copper, of the National Electric Lamp Association, in discussing the paper followed closely the lines of Mr. Doane's paper at the St. Louis convention of the National Electric Light Association and showed by means of lantern slides the nature and the relative magnitude of the various items which go to make up the cost of producing electrical energy and service. He explained by means of diagrams the Hopkinson and Doherty methods of charging which have been used to cover these costs and pointed out the lines along which, in his estimation, an ideal system of charging would be constructed. His discussion was written and was in fact longer than the paper itself, but contained nothing that varied essentially from Mr. Doane's N. E. L. A. paper. He criticised Mr. Conklin's paper in that the statements made carried the impression that it would be necessary under a three-rate scheme periodically to increase the customer charge. The diagrams he showed were apportioned on the assumption that the charge per customer remains constant.

Mr. E. J. Kiefer, of the People's Consolidated Service Corporation, of Easton, Pa., also submitted a written discussion with blue prints of rates based upon the total cost of production plus fixed charges and a margin of profit. In this system the annual kilowatt charge is separated for every customer, or covered in a straight kilowatt charge, his schedule providing the required rates under both conditions. The final rate proposed is based entirely upon the percentage of the customers use of his maximum demand.

Messrs. J. H. Perkins, of Wilkes-Barre; E. F. McCabe, of Lewistown; R. L. Lloyd, of Philadelphia; G. E. Wendle, of Williamsport; F. S. Nicholson, of Sayre; E. H. Davis, of Williamsport, and others joined in the discussion at this point. Mr. McCabe brought out the fact that the scheme proposed by Mr. Doane was not applicable to small stations having residential loads because it necessitated a maximum demand meter in addition to the regular meter, whereas small stations are now overburdened with meters and seek some substitute which is cheaper to buy and maintain. An additional meter, he said, was out of the question. Mr. E. H. Davis maintained that differential rates are seldom honestly applied and in 90 per cent of the cases cannot be applied. In meeting isolated plant competition companies got as much as they could for the service. In residences the rate is almost a flat rate and although stations may claim that differential rates are applicable, in reality customers are paying the maximum rate. The speaker said that there were no scientific rates, and if the customer kicked hard enough, the average manager would find some redeeming feature in his load which would entitle him to an extra discount. The majority of rates are arbitrarily fixed, the station endeavoring to get all that the traffic will bear, regardless of rate schemes in force.

At the final session the following pertinent question was brought up for discussion: Would it be considered good business for a central station of 30,000 hp capacity, that has a heavy day load and evening peak of light and power, to take on large consumers who would use electric power between the hours of 10 p. m. and 7 a. m. at a rate equal to the cost of manufacturing current and delivering same to the consumer? It is assumed that the night load is comparatively light.

There were five other questions of moment prepared for discussion at the meeting, but the time of the association was so taken up with the reading and discussion of the regular papers that they were not put. In discussing the question Mr. E. F. McCabe said that if the load was large a company of the size specified could take it at present cost and earn money. In substantiation he cited the case of a company whose manufacturing cost for energy was 3 cents; but after taking on a fair-sized load the cost was cut in two. Mr. Orr was of the opinion that under certain conditions a company could justify taking on a large load between the hours specified. Mr. Hubbell, of Carbondale, said that a company of the size mentioned in the question could undoubtedly take on a large load at a price equal to the manufacturing cost plus the cost of delivering the energy, because it would not entail additional labor or machinery. It would be out of the question, however, for a smaller company to undertake to take on a load of any proportions, he claimed, because it would mean additional help during the time the extra load was carried.

ENTERTAINMENT FEATURES.

Socially the convention of the Pennsylvania Electric Association was the most cordial ever given and on all sides appreciation was expressed for the excellent entertainment features provided. The opening reception on Tuesday evening was well attended and on Wednesday the accommodations at the hotel, which is equipped for 350 guests, were taxed to the uttermost, the attendance being greater than anticipated. There was a card party provided for the ladies in the morning with expensive prizes for the winners. In the afternoon there was an impromptu musicale with amusements, and a baseball game between the central-station men and supply men, the former being the victors. Motion pictures followed by a cotillon were provided in the dining-room in the evening the hotel ballroom being too small. At this entertainment it was hoped to show a film of an electric kitchen in operation secured from Mr. Gilchrist, of the Commonwealth Edison Company, of Chicago, but owing to some mishap the pictures were not put on the screen. Drives were given for the ladies to numerous interesting localities in the vicinity on Thursday morning, and in the afternoon there was a porch party with prizes for the ladies and bowling and shuffleboard contests with prizes for the men. In addition there was a most excellent vaudeville performance given in the evening, together with motion pictures. Dancing followed until early morning. The men derived very much enjoyment during the week by initiating some members in an impromptu organization known as the "Buzzards." Baseball games and bowling engaged the attention of the stronger sex on Friday and the ladies were taken for a drive to Bear Creek and those who did not care to avail themselves of the privilege engaged in a bowling tournament, prizes being provided for the winners.

NOTES.

The General Electric Company and the Westinghouse Electric & Manufacturing Company made exhibits of meters, lamps, heating devices and other apparatus on the porch of the hotel, while the Simplex Electric Heating Company occupied space in the hotel parlors. Various other manufacturing companies were represented.

On Friday morning a local association of power salesmen was formed, with Mr. Lewis, of the Scranton Electric Company, as corresponding secretary. It was provided that each member send complete details of some motor installation to the secretary, who is to keep a file of these details and each month send a notice to members stating the contents of the file. Members may apply for specific cases on file when needed. Thus, if a prospective customer operates a silk mill, the salesman may consult his list and if information on similar installations is available in the files, he may request the secretary to forward it to him. Each report is to be submitted complete in every detail, since otherwise it would not be of much advantage, and it is hoped that by the interchange of these experiences and data of actual installations and performances great progress will be made in the installation of electric motors throughout the State.

# Central Station
## Management, Policies and Commercial Methods

### CENTRAL-STATION ADVERTISING IN ST. LOUIS.

The Union Electric Light & Power Company, of St. Louis, is conducting its newspaper advertising campaign steadily and persistently. Space is taken regularly in the daily papers to show the advantages of electricity in the home to prospective residence customers and in shops and industrial establishments to users of power. Each day some one desirable feature of electric service, as in the dining-room, the kitchen or the laundry in residences, or the overload capacity of electric motors, for instance, is made the subject of illustration and comment.

### EARNINGS OF THE NEW LONDON (WIS.) STATION.

The third annual statement of the Electric Light & Water Works Commission, of New London, Wis., has been issued for the year ended June 30, 1910, a copy of which has been furnished us by the courtesy of Mr. H. C. Sterling, superintendent.

In New London, the population of which is about 3000, the electric light and water plants are combined and operate together. The total bond interest is $1,900.50, of which $500.04 is charged to the electric light plant and $1,400 to the water plant. The electric plant shows gross earnings from operation of $11,589.36. The expenses, including interest, are $7,853.48. The profits of the electric plant, not including any allowances for depreciation or loss of taxes, are $3,735.88. A gross revenue of $4,195.06 was obtained from electric wiring and supplies. The profits of this business were $345.62. Permanent improvements in the electric plant during the year were made amounting to $1,811.74. The plant now has 353 electric consumers and 126 water consumers. Electric consumers to the number of 70 were added during the past year. There are 140 electric irons and 45 electric fans connected.

### CLASSIFICATION OF ACCOUNTS FOR SMALL COMPANIES.

At the Michigan Electric Association convention, on Aug. 18, Mr. F. B. Spencer, of Cheboygan, read a paper on accounting for central stations in small cities. He recommended the classification adopted by the National Electric Light Association committee on uniform accounts, which he said agrees very generally with the systems required by the New York and Wisconsin State Commissions. This classification is so designed that the small plants may use the system by eliminating a considerable amount of the detail, and still have sufficient conformity to the general scheme to make comparison with larger plants rather easy. He then outlined the necessary accounts for a small property. This outline does not differ greatly from that laid down by the Wisconsin State Commission and the National Electric Light Association.

In discussion of the paper Mr. A. N. Richardson, of Ann Arbor, said that the Wisconsin Commission classification covers both large and small companies and is very completely worked out.

Mr. A. C. Marshall, of Port Huron, president, said that anyone desiring the Wisconsin classification can get it upon application to the Railroad Commission of Wisconsin at Madison, Wis.

Mr. John Cavanaugh, of Benton Harbor, said that his company being a combined railway and lighting company is obliged to make reports to the Michigan Railroad Commission. There are about 100 subdivisions in this classification. He thinks the Wisconsin classification is better. On the whole he considers commission reports good features, as they compel companies to find out what they are doing.

On motion of Mr. Thos. Hinks, of Mount Clemens, it was voted to appoint a committee of three on accounting to report at the next convention.

### CHICAGO SANITARY DISTRICT COMMERCIAL METHODS.

The trustees of the Sanitary District of Chicago, which controls the Drainage Canal water-power at Lockport, maintain a contract department for the solicitation of electric power business which employs methods similar to those of up-to-date private corporations. This department, in charge of Mr. N. F. Obright, contract agent, gives occasional trips down the Drainage Canal from Chicago to present and prospective power users for the inspection of the substation, transmission line, controlling works and hydroelectric plant of the Sanitary District Such a trip was made Sept. 7, when a party of about fifty were taken on the boat *Robert R.* from the State Street bridge in Chicago to the step-down substation at the end of the transmission line at Western Avenue and Thirty-first Street, and then on down the canal to the controlling works north of Lockport concluding with a visit to the hydroelectric power house south of Lockport. Lunch was served on the boat, and the return was made about 5 o'clock. About two-thirds of the party were presidents and vice-presidents of present and prospective power-using concerns and the remainder consisted of engineers and superintendents of such concerns.

### LARGE ELECTRICAL ENAMELING OVEN.

Mr. John A. Cavanaugh, superintendent of the lighting department of the Benton Harbor-St. Joe Railway & Light Company, of Benton Harbor, Mich., read a paper before the Michigan Electric Association at Port Huron, Aug. 18, describing some work done in Benton Harbor in developing a successful electric oven for baking enamel. The experiments were carried on by the metal sectional department of the Baker-Vawter Company and Mr. Cavanaugh's company for the purpose of determining the feasibility of baking enamel on metal sectional filing cases and office cabinets. The first ovens, five in number, were 5 ft. x 7 ft. x 9 ft. The walls were built of first a layer of No. 10 galvanized steel plate, then 1 in. of dead air space, then 1 in. of "vitrobestos" or air-cell asbestos, then another inch of air space and another No. 10 sheet metal plate. The walls and the top of the doors were all of the same arrangement. The doors were arranged to close with screw clamps, making them air tight. It was hoped that these ovens could be heated to proper temperature, and then part of the energy shut off, allowing the oven to finish baking at reduced energy consumption. This, it was found, could not be done with those ovens. As soon as the circuit was broken the temperature fell. Various arrangements of coils inside of the oven were tried. After long continued efforts an arrangement was secured with which with four coils in use the temperature could be raised in one hour to 250 deg. This would have to be maintained for practically four hours, the total energy required being 46.8 kw-hours.

Later an oven was built 6.5 ft. x 8 ft. x 8.5 ft. with but one door, this door being 6 ft. x 8 ft. x 8 ft. Starting on the outside was a ¾-in. layer of hard wood, then a thin sheet of asbestos paper, another thickness of ¾-in. lumber put on diagonally, another thickness of asbestos paper, another thickness of wood, then ½ in. of asbestos. This oven was covered outside and in with polished tin. With four coils it requires one hour to raise the temperature to 210 deg. Fahr. After that the same temperature can be maintained with but two coils. This requires to complete the baking 16.2 kw-hours, or but little more

than one-third the amount required in the former oven. The rate for this energy is 2.25 cents per kw-hour, measured on a primary meter. Three 10-kw transformers, connected delta, three-phase, have been installed, and two ovens are connected on each phase. Ordinarily there are at least three of the six ovens in operation, the two adjacent ovens being connected to the same phase, and one oven baking while the other is being emptied and refilled, making a fairly balanced load of the three-phase circuit.

In discussing this paper Mr. Cavanaugh said that the load is on twenty-four hours a day. He is expecting later to go after bread-baking business. The cost of baking by electricity in this way is less than by steam coils.

## ELECTRICITY ALLOWANCES AT AN ARMY POST.

The quantity of electricity that may be used for various purposes about an army post is subject, like any other commodity which the Government purchases or supplies, to definite limitations which are conveyed in a general order issued by the War Department. These quantities are defined in watt-hours per diem for each lamp installed in the various buildings and quarters, and a table is given showing the consumption permitted for each class of service during each of the four seasons of the year.

In general the quantities apportioned are liberal, since the total amount allowed to any building is figured on the entire number of lamps installed, all of which are not likely to be needed during the full number of hours permitted. The actual consumption in this way is usually less than the allowance, although the saving credited on one year cannot be applied on the following year. An officer in charge of each installation is detailed to enforce the department order limiting the consumption in his building, and when this amount is exceeded, he is expected to make good the cost of the surplus electricity used. The allowances per month are as follows: A captain, 48 kw-hours; a first lieutenant, 36 kw-hours; a second lieutenant, 24 kw-hours, and a non-commissioned officer, 12 kw-hours. Any unused energy is cumulative for the entire fiscal year, but if it is not used within that time the balance is wiped off. Should an officer use more than his allowance he is charged with the excess at the regular rate.

Following are the watt-hours per diem allowed for each carbon, graphitized-filament and tungsten lamp installed in the principal post buildings, as given in general order, No. 49:

| Building | 16-c.p. Carbon | | | | 50-w. Graphitized | | | | 25-w. Tungsten | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan.-Mar. | Apr.-June. | July-Sept. | Oct.-Dec. | Jan.-Mar. | Apr.-June. | July-Sept. | Oct.-Dec. | Jan.-Mar. | Apr.-June. | July-Sept. | Oct.-Dec. |
| Administration | 84 | 56 | 42 | 70 | 66 | 44 | 33 | 55 | 35 | 23 | 18 | 29 |
| Barrack | 196 | 112 | 84 | 168 | 154 | 88 | 66 | 132 | 82 | 47 | 35 | 70 |
| Chapel | 112 | 98 | 98 | 112 | 88 | 77 | 77 | 88 | 47 | 41 | 41 | 47 |
| Drill hall | 168 | 112 | 112 | 168 | 132 | 88 | 88 | 132 | 70 | 47 | 47 | 70 |
| Guardhouse | 224 | 168 | 168 | 224 | 176 | 132 | 132 | 176 | 94 | 70 | 70 | 94 |
| Hospital | 280 | 140 | 112 | 224 | 220 | 110 | 88 | 176 | 117 | 59 | 47 | 94 |
| Officers' assem. and mess | 168 | 112 | 112 | 168 | 132 | 88 | 88 | 132 | 70 | 47 | 47 | 70 |
| Post exchange | 112 | 98 | 98 | 112 | 88 | 77 | 77 | 88 | 47 | 41 | 41 | 47 |
| Power house | 560 | 504 | 448 | 560 | 440 | 396 | 352 | 440 | 234 | 210 | 187 | 234 |
| Stable | 56 | 56 | 56 | 56 | 44 | 44 | 44 | 44 | 24 | 24 | 24 | 24 |

For all posts in the Philippine Islands and in Porto Rico, where the low latitude results in more nearly equalizing the duration of daylight during the seasons, the allowance for the months from April to September is increased 10 per cent, and that for the remainder of the year diminished in the same proportion. Carbon-lamp renewals for officers' and non-commissioned staff officers' quarters are limited during any year to 40 per cent of the total number of lamps installed, and for public buildings 60 per cent, except when the voltage employed is over 200 volts, when the renewal allowances become, respectively, 60 and 90 per cent of the total lamps installed. For tungsten lamps the yearly renewal allowance is 25 per cent for officers' quarters, and 35 per cent for public buildings.

In many instances the Government prefers to purchase its electrical energy from the nearest central-station company rather than to undertake to generate it in its own local isolated plant. The post near Des Moines, Ia., obtains its service from the Des Moines Electric Company, and Fort Benjamin Harrison, near Indianapolis, purchases its supply at 5 cents per kw-hour from the Indianapolis Light & Heat Company.

## CONSTRUCTION OF UNDERGROUND STEAM HEATING MAINS.

In a paper read before the Indiana Electric Light Association at its convention in Indianapolis, Aug. 18, Mr. MacWilliams, mechanical engineer of the Indianapolis Light & Heat Company, discussed the construction of underground steam-heating mains as installed by his company.

To insure successful operation, said Mr. Williams, the underground plant should be installed by skilled labor under the direction of an experienced engineer. For durability, genuine full-weight wrought-iron pipe should be used, and this should be tightly wrapped with asbestos paper held firmly by spiral windings of copper wire. Of the several insulating materials available, such as concrete, tile and white-pine casing, the last-named is recognized from experience as standard and one of the best. It is a good insulator, reasonable in price, and is durable.

The standard construction as built by the American District Steam Company is made up of air and kiln-dried white-pine staves, free from sap and moisture, and tongue-and-grooved throughout their length. The staves are from 4 in. to 5 in. thick and about 3.2 in. wide. They are bound together with a 3/16-in. galvanized steel wire under pressure sufficient to embed the wire deeply in the wood and so leave a practically smooth surface. The whole is covered with asphaltum to a thickness of about ¼ in. to protect it from deterioration, and then rolled in sawdust to facilitate handling. The ends are carefully mortised and tenoned so that when two pieces are put together a driving fit is obtained, making a water-tight joint. The joint is then sealed with hot pitch. When installed, the casing is covered over the top and down the sides to a point below the center with three-ply tar paper, to protect it from moisture in the ground.

The inside of the casing is tin-lined, the diameter being made from 2 in. to 3 in. larger than the wrought-iron pipe over which it is to go. Guides are placed every 7 ft. to hold the pipe in the center of the casing. By this means a dead-air space of from 1 in. to 1½ in. is obtained between the asbestos-covered pipe and the tin-lined casing. The tin is used to protect the wood from the heat, and it also acts as a reflector.

The casing is further protected from the water which might collect under or around it by placing two 4-in. drain tiles at each side of the trench and below the bottom of the casing. The tile should be put in to grade and have the proper outlet to a sewer or cesspool. To increase the efficiency of the tile, it should be covered with broken stone or coarse gravel.

An ingenious device called the "variator" is used to take care of temperature expansion and contraction, which is about ¾ in. for each 50 ft. of pipe. The variator is built to take the expansion of about 50 ft., and so a double variator is placed every 100 ft., with an anchor special, midway between, to anchor the other ends. The center part of the variator is anchored in a brick box, built about it, while the flanged ends are left free to move in or out as the case may be. To the anchored part is fastened the outside edge of a corrugated copper diaphragm, the inside edge being fastened to the free ends of the pipe. This gives a packingless expansion device which, when covered with oiled shavings, is bricked over and needs no further attention.

The anchor special is nothing more than an eccentric cross. Provision is made for anchoring it firmly in a brick box which is built about it. It is also packed in oiled shavings and after it is bricked in the street is repaved over it.

In the variator and also the anchor special two openings are

provided for service connection, one on each side of the fitting, so that services may be run to each side of the street. These openings are as near the top of the fitting as is possible in order to insure the delivery of dry steam to the customer. From this arrangement there are two service conections for each 50 ft.

## AN ENGLISH VIEW OF CENTRAL-STATION RATES.

A paper read at the meeting of the British Association at Sheffield, England, on Sept. 1, upon the subject of the "Price of Electricity," by Mr. Edward W. Cowan, deals with the much-discussed question of methods of charging for electrical energy. The author contends that, in the case of any supply which is subject to a reduction in cost of production per unit as the quantity supplied is increased, it is impossible to attribute a separate cost to any part of that supply, and that it is only the cost of the whole output which can usefully be taken into account. If that view be admitted as being a valid one, he holds that the system of attempting to base the price of supply to each customer upon the separate cost of supplying him falls to the ground.

Assume, he says, that in a central station there is a normal demand for an output of 3,000,000 units for lighting use at 4 cents per unit, and that the conditions are such that if the output could be doubled the total cost of production per unit would be reduced by 25 per cent. Further, assume that the expenses of production are such that at 3,000,000-unit output the cost is 4 cents per unit, or in other words that at that output no profit is made. Now let us suppose that a prospective consumer presents himself and offers 2½ cents per unit for a 3,000,000-unit supply of the same character in respect of load factor, etc., as the existing supply. The engineer makes a rapid calculation thus: He notes that his output will be doubled and he is fully aware that his cost of production per unit will be reduced from 4 cents to 3 cents under such circumstances. Is he to refuse this customer because he is only paying 2½ cents per unit for electricity which "costs" 3 cents to produce? His undertaking with its present output makes no profit, but with this consumer's demand added to the existing demand an aggregate profit will be earned of $15,000. If a separate cost can be attributed to a part of a supply under such conditions one arrives at the paradox that a profit can be made of $15,000 by selling 3,000,000 units at a loss of ½ cent per unit. It is obvious that a profit cannot be made by selling at a loss, and the conclusion one is forced to accept is that the sale is not made at a loss. The assumption that this customer's supply can be considered as having a separate calculable cost is, the author asserts, faulty. It is only the aggregate supply which, under such circumstances, can have a calculable cost of production.

Mr. Cowan in his paper quotes many leading English engineers, including Arthur Wright, J. H. Rider, Robert Hammond, C. H. Wordingham, J. F. C. Snell, etc., and contends that the system of charging which these engineers advocate, which system is adopted generally by central stations all over the world, is based upon the supposition that the cost of supplying each customer can, in theory at any rate, be arrived at, whereas such a figure is really unattainable In referring to the attempt to arrive at the cost per ton-mile of freight moved by a railway, the late Prof. Taussig pointed out in 1891 that the figure when found represented "no real thing whatsoever."

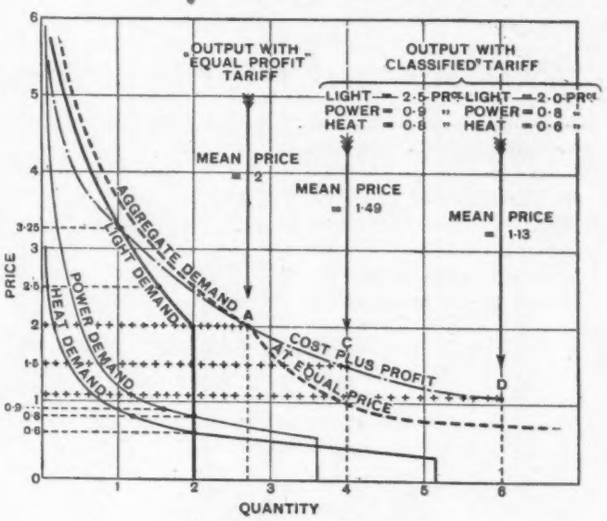
The author then proceeds to develop a system of charging which he recommends should take the place of the existing system. The system he advocates is based upon the railroad "classification" or "discriminative" rates. In this system attention is concentrated upon aggregate results and the question whether any individual consumer is being supplied at a profit or at a loss is disregarded, excepting that the encouragement of the most profitable consumer is recognized as contributing to the prosperity of the business interest as a whole. The fact that electricity is put to various uses is taken advantage of to differentiate between the charges to the different classes. It is claimed that the demand for electricity is in reality a demand for light, heat, power, etc., and the fact that electricity is common to the supply of these commodities is a fact of no essential economic bearing. Each use of electricity has its market price determined by the price of competing methods of attaining the same end and also by the specific utility of the electrical method. It is proposed that prices for each use shall be fixed as closely as possible to the market price of the particular service so that *in the aggregate* (1) the mean price shall bear as high a proportion to the mean cost as possible (consistent with a right use of the monopolistic power which is involved in electricity supply); (2) the mean price shall be as low as possible, and (3) the supply shall be as large as possible. The author states that if this system be faithfully and wisely carried out both producers and consumers gain in the aggregate, and that none are penalized for the sake of subsidizing others.

In the following diagram the author gives a graphic representation of this principle of "classification" which he says demonstrates the specific advantage which can be attained by its practical operation.

There are four characteristics indicated in this diagram, as follows:

(1) Cost of production in relation to the dimensions of the output with profit added.

(2), (3) and (4) The characteristics of the relation between




Classification of Charges.

demand and price of electricity for light, power and heat uses respectively. The aggregate of these three classes of demand (at equal price) is also plotted. (Dotted black.)

The point where the "cost plus profit" curve crosses the "aggregate demand" curve indicates the maximum output obtainable at "equal price" (or equal profit) from all three classes of consumer. Under the condition assumed in the diagram it is seen that the maximum demand obtainable at "equal price" is 2.7 at price 2.

If discrimination is made in the price charged as between the different classes of consumer, under the conditions assumed in the diagram, a very much larger output is obtainable, and further, it is supplied at a much lower mean price. If, for instance, the light consumers are charged 2 as before, the power consumers 0.8 and the heat consumers 0.6, the output is increased from 2.7 to 6 and the mean price reduced from 2 to 1.13 per unit.

It will be noted that both the power and heat consumers are charged prices appreciably below the "cost" of supplying them (that is according to the orthodox conception of the cost of supplying them) and yet a handsome profit is realized by doing so.

The characteristics of this diagram may be approximate to or widely differ from the actual conditions of demand in any given area, but the author considers that principle remains unassailable, as it is clearly a principle of essential economy under certain conditions. It is true that the license to "clas-

sify" may, in incompetent hands, or in grasping hands, be abused and no one will dispute that "personal" discrimination as compared with "class" discrimination should be strictly prohibited. But if the higher planes of successful undertaking are to be reached the fact that a system otherwise beneficial is open to abuse must not be allowed to stand in the way, but rather protective regulation and restriction should be employed to minimize the danger.

It is also true that there is a danger of miscalculation in "classifying" tariffs and the consequence of an error may be that mean price may fall below mean cost. This will happen if the course of demand of one use of electricity is wrongly estimated and a larger quantity of low-priced supply is demanded than is justified by the course of demand for relatively high-priced supply. Such danger should be met by providing a margin to meet the result of possible error and also possibly by setting aside a reserve which will be available to make good any deficiency, until alteration of price can be made and the error rectified.

In conclusion the author says that in view of the enormous field of potential demand for electricity for power and heat use, which cannot be reached at present because price bars the way, none will disagree with the conclusion that "we cannot afford to disregard any principle, however small its dimensions may be, which is a principle of essential economy."

# Wiring and Illumination

## EXTENSION OF STREET LIGHTING IN BUDAPEST.

In our issues dated Oct. 21, 1909, and April 28, 1910, Mr. Francis Jehl described a trial street-lighting system with Alba arc lamps in Budapest, which Mr. Etienne de Fodor, general manager of the Budapest General Electric Company, erected at his company's expense. The results of the test have proved so gratifying to the municipal corporation that it has not only decided to take over and pay for the cost, but has given the Budapest General Electric Company an order for the lighting of Andrássy Street (the Fifth Avenue of Budapast) and the second part of Rákoczi Street with 160 Alba lamps.

Ornamental Lamp Standard.

The city authorities have further decided to have all the main thoroughfares of the city lighted with arcs in the near future. This practical experiment that Mr. de Fodor made to convince the municipality of Budapest that the arc is the proper thing for street lighting may be taken as an object lesson by central-station managers, because it shows that taking a financial risk incurred in introducing a good thing is worth far more than any amount of talk or persuasion, for the laity are always better satisfied when they see the real thing and are not obliged to buy a "cat in the bag." The accompanying illustration shows one of the new ornamental standards, which are also fitted for gas, which is lighted after the arcs are extinguished at midnight. The combined type, however, is only used at the intersection of large avenues or squares, where the standards are erected on small islands in the roadway. Those placed on the curb of the street have no gas lamp, but are equipped with a flower basket.

## DIMMERS IN CHURCH LIGHTING.

The lighting installation of St. George's Military Church, at Aldershot, England, is unique in that dimmers are used for the purpose of varying the intensity of illumination. Two large wire-resistance dimmers are installed at one end of the church and are operated by an attendant, who modifies the light according to circumstances. For instance, when the congregation is assembling a moderate illumination is provided and later the resistance is entirely cut out and the church becomes brilliantly lighted. Then during the sermon the illumination can be reduced to a dim glow, which is at once impressive and appropriate.

While, of course, there is little saving of energy, the system is particularly adapted to church lighting. The first cost of installation with dimmers is said to be less than that of the usual method, as the expense of the many long switch runs is avoided.

## COMBINED SERIES ARC AND INCANDESCENT LIGHTING CIRCUITS IN CANADA.

For the lighting of the streets of Barrie, Ontario, Canada, use is made of fifty-two enclosed carbon-arc lamps of the 6.6-amp type and sixty 40-watt incandescent tungsten lamps of the 6.6-amp type. The tungsten lamps are at present operated on circuits distinct from the circuits of the arc lamps, each circuit being fed with energy through a separate constant-current regulator. The ampere ratings of the lamps were made equal in order that lamps could be used interchangeably upon the various circuits. Advantage will soon be taken of the arrangement in increasing the illumination in certain sections where tungsten lamps are now used and where arc lamps will be directly substituted therefor.

## SPECIAL STREET LIGHTING ENHANCES PROPERTY VALUES.

That special street lighting enhances the value of outlying business property thus made attractive and conspicuous at night was recently demonstrated in St. Louis. Through the efforts of the Easton Avenue Improvement Association special ornamental street lamps were placed on Easton Avenue in the block bearing "4500" numbers. Lamps were placed every 25 feet on both sides of the street, electricity being furnished by the Union Electric Light & Power Company. The results were immediately beneficial. The business of the merchants was increased, vacant stores were rented, rents were increased, and various improvements were made. An offer of $1,000 a front foot was made for the lot on the northwest corner of Easton and Taylor avenues, which is a record for that section of the city. Real estate men and property owners attribute the advance entirely to the illumination of the street.

## DECORATIVE LIGHTING FOR THE TORONTO EXHIBITION.

The lighting circuits of the buildings of the Toronto Exhibition have been rearranged for the purpose of supplying better illumination and reducing the fire risk. Many of the exposed conductors have been replaced by underground conduits; larger conductors are used and the switching arrangements have been improved. Ornamental cement lamp-posts have been placed along the main plaza road, around the horticultural building and along the driveway to the main gateway. Each post will be equipped with three 110-volt, 60-watt tungsten lamps.

Each of the buildings has been outlined with rows of 8-cp carbon lamps. These lamps receive energy through Norbit sockets, which have been employed in order that the wires may be removed subsequently and used for other purposes; the sockets are provided with contacts which simply puncture the insulating coverings of the wires. It is said that about 6000 additional small lamps are being used this year. The total expenditure for the improvements and extensions to the lighting equipment will reach $75,000.

## SPECIFICATION FOR INSULATING TAPE.

At the convention of the Pennsylvania Electric Association, held at Glen Summit Springs, on Sept. 14, 15 and 16, the committee on overhead-line construction, of which Mr. Thomas Sproule was chairman, submitted a report containing many valuable data relating to aerial circuits. One of the special features of the report was a list of specifications for insulating tape prepared from data furnished by various tape manufacturing companies and also from the specifications which were prepared by the American Telephone & Telegraph Company. These specifications are given in full herewith.

*General.*—The article desired under these specifications consists of a thin, flat braid, or tape, impregnated with an adhesive and insulating compound.

*Braid.*—The braid shall consist of a tough woven fabric not more than 0.015 in. nor less than 0.010 in. in thickness.

*Compound.*—The braid shall be thoroughly impregnated and covered with an adhesive and insulating compound, which shall amount to not less than 70 per cent nor more than 75 per cent, by weight, of the finished tape. The compound shall contain no active sulphur nor any other substance which will act injuriously on copper, iron or other metals, or on the braid. The compound shall adhere firmly to the braid.

*Length.*—The total length of 0.75-in. tape, after the insulating compound is applied, shall not be less than 160 ft. per lb.

*Solubility and Absorption.*—The compound shall be insoluble in water. The finished tape, when exposed to a moist atmosphere of approximately 90 per cent humidity for forty-eight hours, shall not absorb more than 2 per cent by weight of moisture.

*Insulation.*—When submerged in water, and after having been submerged in water continuously for 48 hours, a standard taped joint shall have an insulation resistance of not less than 1000 megohms. The joint to be tested shall be a standard Western Union joint in No. 14 B. & S. outside distributing wire. The distance between the ends of the insulation or length of the bare wire exposed in the completed joint shall not exceed 1.5 in. The joint shall be wound with two wrappings of tape, put on in reverse layers, with 0.5-in. overlap. The length of the taped joint shall be 2.5 in. In testing the tape the joint and 2 ft. of the wire shall be immersed in the water.

*Mechanical Strength.*—The tape shall be of sufficient strength to permit of its being tightly wound or applied without tearing or other injury.

*Durability.*—The tape, if kept in the roll, shall be guaranteed to show no marked deterioration in adhesiveness or insulation at the end of one year.

# LETTERS TO THE EDITOR.

### Converter Substation Design.

*To the Editor of Electrical World:*

SIR:—In the article in your issue of Aug. 4 entitled "American Switchboard Practice," under the subheading "Converter Stations" there is illustrated and described a certain type of substation without, however, any reference to the source of the schematic layout and arrangement of the apparatus shown. In order to supply this latter information I may say the cross-section as illustrated appears to be a direct copy, even to many small details, of a converter substation developed and built by the Brooklyn Rapid Transit Company and adopted as more or less standard by that company for its 2000-kw unit, 10,000-kw rotary substations.

This type of substation has so proved its superiority from an operating standpoint for railway work that it has been accepted by the Boston Elevated Railway Company. A description of the substation of this type built by the latter company is given in an article printed in the *Electric Railway Journal* of March 5, 1910.

*Brooklyn, N. Y.* A. K. MILLER.

### A Correction.

*To the Editor of Electrical World:*

SIR:—It has recently been brought to my attention that a typographical error appears in several of the equations in my paper "On the Radiation from Metals" as printed in your columns in the issue dated June 23, 1910, page 1654. In the two equations for "$\sigma$" found on page 1656, the letter $T$ is erroneously substituted for the Greek character $\Gamma$ (gamma), which is not multiplied by $(a-1)$, but refers to the gamma function of $(a-1)$. The two equations to which reference is made should, therefore, read as follows:

$$\sigma = C_1 \Gamma (a-1) \frac{1}{C_2^{a-1}}$$

and, three lines below—

$$\sigma = C_1 \Gamma (a-1) \frac{1}{C_2^{a-1}} \sum_{n=1}^{n=\infty} \frac{1}{n^{a-1}}$$

*Cleveland, Ohio.* EDW. P. HYDE.

### Conflict of Water-Power Rights in Different States but Located on the Same Stream.

*To the Editor of Electrical World:*

SIR:—The recent Conservation Congress at St. Paul has brought to the front the question as to whether our nation's undeveloped water-powers, or at least such of them as are now not the property of individuals, shall be disposed of under the direction of the National Government or of the states. There are a number of considerations that may be raised in favor of each of these plans, some of which have been prominently brought forward and some of which have not been clearly pointed out. The present would seem to be the proper time to discuss all pertinent conditions, and the writer wishes to call attention through your columns to a matter that seems vital in the handling of water-power privileges. The principle is this, that once rights in any water-power have been granted to a person or a corporation, no other user of the water, located in a different state, shall have the right to interfere with the normal contemplated utilization thereof. Since our streams furnishing water frequently traverse more than one state, if these states are held to have unlimited sovereign rights over all water within their own boundaries, it will be perfectly possible for one state to nullify rights previously granted by another.

The seriousness of this possibility can be made clear by a hypothetical example. Suppose a plant to be established on a stream near a state boundary, the stream coming from the next state and that this plant has built up a load to the full normal capacity of the water-power and has enjoyed this load for some time, when another plant is established on the same stream higher up, and in the next state. We may further assume the not unlikely contingency that the upper plant has a considerable pondage and that the lower plant has little or none. The natural tendency of the upper plant will be to store water, at least during dry times, during Sundays and holidays for the heavier loads of other days. But the lower and older plant will not get the benefit of such storage at the time when extra water is needed and will actually experience a shortage of water as a result of the accumulating of the Sunday flow at the upper plant, which shortage will occur as much later than the Sunday storing period at the upper plant as the time required for the water to flow from one plant to the other; and such a deficiency of water might very likely occur at such a time as to require a cutting down of the station load or the adding of a steam relay station. Where the two plants are close together the daily load variations might easily cause the lower plant to have plentiful water in the early hours of the morning and comparatively little water during the peak load.

This possibility of a later-built plant taking advantage of an older plant, while not likely to occur often, is by no means a negligible danger. The writer knows of at least one such case. Such an injustice is, of course, provided against within the jurisdiction of any one state, where the first user has the right to his water. The point to be made is that such a method of control for public water-powers should be established, whether primarily under the states or under the National Government, that the later comer is bound to respect the rights of earlier plants even when in other states.

This general principle of interstate interference in the use of water has been before the public many times, one instance being in connection with the Chicago drainage canal, and possibly there may be some sort of roundabout legal redress at the present time, but this is not sufficient. Protection for the development of a water-power free from such disturbance should be definite and clean-cut and easily and cheaply invoked.

It would seem that the particular feature of water-power development concerned with the effect of one station's method of use on another station's supply would properly come under the jurisdiction of the National Government when the stations were in different states. There would seem to be no reason, however, why such matters as period of franchise grants and terms of payment therefor and similar matters might not be provided for entirely separately from interstate interference nor any reason why there should not be simultaneously both state and national regulation.

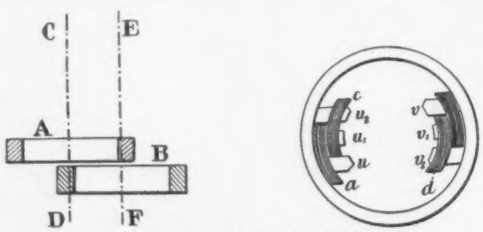
*New York.* Percy H. Thomas.

# Digest of Current Electrical Literature

**ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD**

### Generators, Motors and Transformers.

*Variable-Speed Motor.*—P. Bary.—An illustrated article on the B. V. D. system of variable-speed direct-current motors with stationary brushes. The motor belongs to the commutation-pole motors class, but does not have interpoles distinct from the main poles. The two kinds of poles encroach on each other. The principle is indicated in Fig. 1, where two




Figs. 1 and 2—Variable-Speed Motors.

coils *A* and *B* are shown. If *A* alone is excited the axis of the flux is *CD*. If *B* alone is excited the axis of the flux is *EF*. If both coils are excited the axis of the flux is parallel to *CD* and *EF* and between the two. When such overlapping windings are placed on each pole of a motor the axis of maximum magnetic flux can be displaced at will by adjusting the excitation of both windings and this effect is equivalent to a change of the position of the brushes with respect to the poles. Since wide speed variations of a motor are possible if the brushes can be displaced at will, the above arrangement serves equally well. Applied to a two-pole motor it is shown in Fig. 2. The author discusses at some length the use of such motors for traction purposes and the possibility of recuperating energy in traction.—*La Lumière Elec.*, Aug. 20.

*Voltage Drop of Polyphase Synchronous Machines.*—J. A. Schouten.—The voltage drop of a machine is caused by the apparent resistance of the armature and the reacting m.m.f. of the armature current. The principal problem is, therefore, to determine this reacting m.m.f. The author first discusses an approximate graphical method formerly used and an analytical method of Blondel. Only the analytical method permits one to determine correctly and quickly the m.m.f. In determining its value the author shows that former formulas on armature reactance, etc., were incorrect. The results of the author's theory are compared with success with the experimental results obtained on a single machine, and the author suggests testing the results of this theory on other machines. He finally shows that the calculation may be shortened by avoiding the graphical method.—*Elek. Zeit.*, Sept. 1.

*Currents in Bearings.*—L. Berger.—A French translation in abstract of a recent German paper of Adler on the origin of the currents which pass through the bearings and frame of dynamo-electric machines and means of avoiding them.—*La Lumière Elec.*, Aug. 27.

*Short-Circuit Test.*—L. Berger.—A French translation in abstract, with illustrations, of the recent German paper of Doczekal on short-circuit tests of direct-current machines.—*La Lumière Elec.*, Aug. 27.

### Lamps and Lighting.

*Mercury-Vapor Lamps for Sterilization of Water.*—M. von Recklinghausen.—An illustrated article on the sterilization of water by ultraviolet rays produced from the mercury-vapor quartz-globe lamp. The quartz globe is used in order to permit the passage of the ultraviolet rays which would be absorbed by a glass tube. A small water sterilizer has been constructed for hospital use, where 132 gal. of sterilized water are produced per hour from ordinary city water by means of one Cooper Hewitt "silica" lamp, absorbing 3 amp at 110 volts. (Fig. 3). The mercury-vapor lamp is placed in the dome top of the apparatus. The water enters the chamber formed by the outer cone with a swirling motion. At the top of this cone it overflows and finds an outlet at the discharge pipe at *B*. The swirling motion is maintained during the complete passage of the water through the apparatus in order that it may be thoroughly stirred up and all microbes presented to the action of the light, the water coming under its influence on two distinct occasions. Drain cocks *P* are provided on the apparatus to enable it to be thoroughly drained should circumstances arise whereby it is not to be used for a considerable time.—Lond. *Elec. Rev.*, Sept. 2.

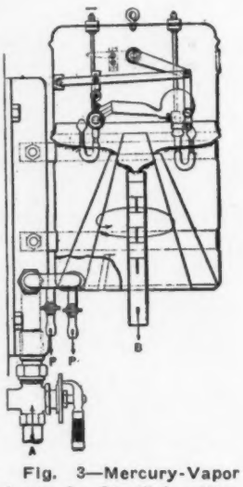



Fig. 3—Mercury-Vapor Lamp for Sterilizing Water.

*Flame-Arc Carbons.*—A note on two recent British patents (18,469, 1909; and 15,977, 1910; Aug. 25, 1910) of F. M. Lewis. The first patent covers a process of manufacturing flame-arc lamp carbons consisting of a tubular or solid core of hard carbon with an outer sheath of flaming material compressed over the core. The second patent covers a flaming mixture of equal parts of calcium fluoride and silicon carbide with a "binder of gold size." A sheath of this material 1.4 mm thick is applied to a core 11 mm in diameter with a 6-mm central hole. After baking, the electrode is given a protective coating of water-glass.—Lond. *Elec. Eng'ing*, Sept. 1.

*New Flame-Arc Lamp.*—A note stating that the Allg. Elek. Ges. of Berlin purposes to place on the market a new flame-arc lamp for currents of from 8 amp to 12 amp, characterized by long lighting hours, which amount to from 80 to 100, as compared with 16 hours in the case of flaming arcs of the ordinary type. It is said that the advantages of the lamp consist prin-

cipally in the reduction of the cost of carbons and attendance the lamp being suitable for external lighting and the illumination of high factory rooms. No details of the construction are yet given.—Lond. *Elec. Rev.*, Sept. 2.

*Advertising Signs.*—W. A. G. MÜLLER.—A paper read before the annual convention of the Verband of German Electrical Engineers. The author describes various new automatic switches for the intermittent illumination of advertising signs. These switches are operated either automatically by a hot wire or by small electric motors.—*Elek. Zeit.*, Sept. 1.

*Lighting Bowling Greens.*—W. G. RHODES.—An illustrated description of a method of lighting bowling greens by means of 50-cp and 100-cp osram lamps.—Lond. *Elec. Rev.*, Sept. 2.

**Generation, Transmission and Distribution.**

*Circulating Water.*—W. N. Y. KING.—An article describing some experiments on the regulation of circulating water in connection with a condenser plant.—Lond. *Elec. Rev.*, Sept. 2.

**Traction.**

*Railless Traction.*—P. A. MOSSAY.—Illustrated notes on the Koehler Namag system of railless traction in use in several places in Germany. The principal novel feature seems to be the overhead equipment. It consists of two hard-drawn copper wires suspended one above the other in a vertical plane, while the current-collecting device is a combination of the trolley wheel and the bow. The trolley wheels, two in number, run on the upper negative wire and the two bows are pressed against the lower part of the underlying positive wire by means

Fig. 4—Trolley for Railless Traction System.

of a spiral spring (Fig. 4). The current is led to the vehicle by means of a flexible line which winds itself automatically on a drum mounted on the car, enabling this latter to behave on the road with the ease and freedom of a self-propelled vehicle. The current-collecting device is further fitted with an elastic articulation which guards the overhead system from the shocks which are caused by the sudden starting or stopping of the car. The motor is either an 8-hp or 14-hp moderate-speed continuous-current series machine, fitted with commutating poles. The main field is wound in two sections, thus permitting series-parallel speed control.—Lond. *Electrician*, Sept. 2.

*British Railways.*—W. E. DALBY.—His presidential address before Section G of the British Association for the Advancement of Science. The author gives figures and curves on the development of British railways, with special reference to the cost of working per train-mile, etc. He then takes up locomotive problems, gives characteristic curves of steam locomotives, and finally discusses the development of electric railways which began in England at the end of 1890.—Lond. *Electrician*, Sept. 2.

*Brooklyn.*—In a continuation of the long series of articles on the line department of the Brooklyn Rapid Transit system a detailed description of the third-rail maintenance, high-tension work, feeders and miscellaneous features is given.—*Elec. Rail. Jour.*, Sept. 10.

**Installations, Systems and Appliances.**

*Restricted-Hour Supply.*—P. J. PRINGLE.—The conclusion of his long article on the restricted-hour system of power supply. The author emphasizes that the restricted-hour system should not be confounded with the two-rate system. The latter has a considerable element of risk as there is no sound provision for ensuring a proper return for the capital charges incurred by the maximum demand of supply. It is a system far less sound than the maximum-demand system or a fixed price per kilowatt of demand with a low price per kw-hour. Entire restriction should be aimed at, otherwise a consumer must be made to pay his fair proportion of the capital charges incurred by his demand. After briefly summing up the general arrangements of the restricted-hour system the author gives figures and diagrams showing the effect of this system on the central

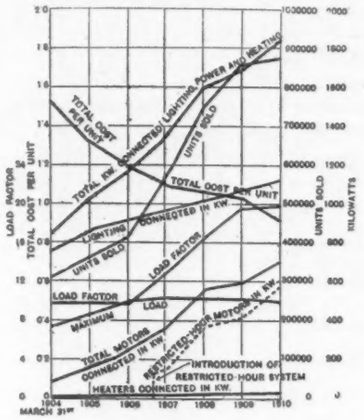



Fig. 5—Curves of Loads, Costs, Etc.

station of Burton-on-Trent. Fig. 5 gives the curves for the connections, load factor, etc., during three years each before and after the introduction of the restricted-hour system. They deal with the alternating-current supply only and do not include the direct-current supply, which is used for tramway purposes only. Curve I shows the lowness and the constancy of the load factor previous to the introduction of the restricted-hour system, and how, after its introduction, it immediately took a strong upward movement and maintained it. Total kilowatt connections have increased year by year at a greater rate since its introduction than before. After its introduction the load factor, which was 9.67 per cent for the year ended March 31, 1906, was raised to 19.63 per cent for the year ended March 31, 1909, or an increase of 100 per cent in three years. The curve shows in an interesting manner the yearly rise in maximum demand previous to its introduction and its constancy afterward, notwithstanding that the kilowatt connections increased at a more rapid rate. Further, the curve for the restricted-hour motors connected gradually gets closer to the curve for the total motors connected. This is due to motors which were running unrestricted being transferred to the restricted class. Other curves giving the operation of the system week by week for four years are also given.—Lond. *Elec. Rev.*, Sept. 2.

*British Central Station.*—An abstract of last year's financial report of the municipal central station of Bolton. In the preceding year the output of electrical energy had decreased on account of trade depression and the increased use of metallic-filament lamps. During the past year, however, the output of electrical energy has increased for all purposes. Private lighting shows an increase of 3.6 per cent power 22 per cent and traction 4.1 per cent. Since the average price received from power users was only 1.624 cents per kw-hour (1.70 cents a year ago), while lighting consumers obtained their energy at an average price of 5.5 cents per kw-hour (5.62 cents a year ago), it is evident that cheap power supply by no means implies penalizing lighting and other consumers. The total costs (excluding capital charges) were 1.12 cents per kw-hour, while capital charges amounted to 0.92 cent per kw-hour, the inclusive cost, therefore, being 2.04 cents, as against 2.14 cents last year. The plant capacity remains unchanged, viz., 7600 kw, the maximum load recorded during 1909-10 being 5941 kw, compared with 4925 kw in the year 1908-9. The load factor continues to decrease, being now only 23.1 per cent, as against 24.75 per cent a year ago and 27.35 per cent in 1907-8.—Lond. *Electrician*, Sept. 2.

*Electric Cooking.*—F. R. Cripps.—An illustrated description of a simple domestic electric cooking outfit used by the author in his own household of three persons. The outfit is partly home-made. Besides the other advantages of electric cooking it is claimed that at 2 cents per kw-hour it saves money.—Lond. *Elec. Rev.*, Sept. 2.

### Wires, Wiring and Conduits.

*High-Tension Cables.*—M. Höchstädter.—A translation of his recent German paper in which the author describes experiments made on paper cables at high pressures with a view to determining the dielectric losses in the insulation. The pressures were gradually increased until the insulation broke down; and from the oscillographic records the author describes a method which he has devised for drawing the so-called hysteresis curve, corresponding to that for the magnetization of iron. He also shows that there is apparently no "viscosity" traceable in paper cables, and that the breakdown takes place suddenly. He concludes with some remarks on the design of insulated transmission cables and effect of frequency. The same issue contains a long editorial on dielectric losses in cables.—Lond. *Electrician*, Sept. 2.

### Electrophysics and Magnetism.

*Corpuscular Hypothesis.*—W. H. Bragg.—A paper in which the author first relates the case for the corpuscular hypothesis of the Röntgen and gamma rays, according to which these radiations consist of streams of discrete entities. He then discusses at considerable length the consequences of this hypothesis. One of these consequences is the general principle that if one radiant entity ($\alpha$, $\beta$, $\gamma$, $X$ or cathode ray) enters an atom, one and only one entity emerges, carrying with it nearly all the energy of the entering entity. We are to think of each entity as possessing initially a certain store of energy which it spends gradually as it goes along, the result being ionization of the material through which it passes; there are no sudden accessions or withdrawals of energy; the path is not necessarily straight, but made up of a number of small pieces more or less straight, the deflections or turnings being the result of intra-atomic collisions; the $\beta$ rays are very liable to such deflections, and the cathode rays even more so. Certain conversions of form may take place, $\gamma$ into $\beta$, $X$ into cathode rays, and so on, but in such cases the energy is handed on, and in some cases at least the momentum. The essence of it all is the recognition of the individuality of each entity, which is to be followed by itself from its origin, through all its changes of direction and sometimes its changes of form, until its gradually diminishing energy becomes too small to render it distinguishable.—*Phil. Mag.*, September.

*Splashing of Mercury.*—J. J. Lonsdale.—An account of an experimental investigation of the ionization produced by the splashing of mercury. The results are summed up as follows: Splashing mercury on an iron plate produces a large excess of positive ions over negative ions. A considerable proportion of these ions have a very small velocity. The amount of ionization depends on the nature of the surface on which the splashing is produced. The current-voltage curves for the positive ions show peculiarities which may be most readily explained by supposing the presence of neutral doublets, which are broken up by the field or other means. Below certain heights these doublets are not produced. Similar peculiarities in the saturation curve for the positive ions of aluminum phosphate and lime are also noticed. The negative ions from these three sources show no such peculiarities.—*Phil. Mag.*, September.

*Hysteresis Loops.*—S. P. Thompson.—A paper read before the British Physical Society on hysteresis loops and Lissajous' figures and on the energy wasted in a hysteresis loop. He shows that any hysteresis loop can be analyzed into a harmonic series of closed curves corresponding to the various terms in the analysis of the current wave. These constituents of the hysteresis loop are examined at considerable length in the paper.—*Phil. Mag.*, September.

*Alpha Particles.*—D. Owen.—A review of Rutherford's work on the alpha particle, giving a sketch of his extended researches on the electric charge and the mass of the alpha particles emitted from radioactive substances and the identification of the alpha particle as a positively charged atom of helium. Finally a summary is given of the different determinations of the "natural unit" of electricity.—Lond. *Electrician*, Sept. 2.

*Hysteresis.*—C. F. Guilbert.—A discussion, with special reference to a recent German article of C. Breitfeld, of the phase displacement and the phenomena of hysteresis in alternating-current circuits containing iron. The discussion is chiefly mathematical and a suitable graphical representation of the phenomena is given.—*La Lumière Elec.*, Aug. 20.

### Electrochemistry and Batteries.

*Ozonization of Water in Russia.*—It is reported that it is proposed to erect a water sterilization plant by means of ozone in St. Petersburg at a cost of $3,000,000. This scheme is on the point of being submitted to the Ministerial Council. The Siemens & Halske Company built a similar but smaller plant a year ago in St. Petersburg, and the approaching presentation of the new scheme is said apparently to show that good results have been obtained from the ozonization of water.—Lond. *Elec. Rev.*, Sept. 2.

### Units, Measurements and Instruments.

*Electric Resistance Thermometers.*—H. L. Callendar.—His presidential address to the British Physical Society on electrical recording thermometers for clinical work. The author first discusses the objections which have formerly been raised against electric resistance thermometers, namely, (1) that they are more difficult to construct and to insulate satisfactorily than thermocouples, and (2) that their indications are liable to be disturbed by the heating effect of the current employed. He shows that objection (1) is readily surmounted by proper methods of construction and objection (2) by a proper consideration of the conditions of sensitiveness. As to the latter point he shows that the limiting condition is imposed by the heating of the current on the resistance to be measured and the resistances, etc., should be so chosen and arranged as to give the greatest sensitiveness for a given limiting value of the current through the resistance to be measured. In an arrangement of the Wheatstone bridge, as indicated in Fig. 6, the

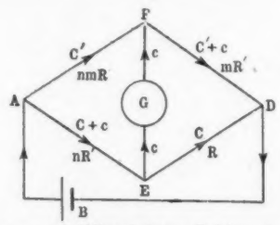



Fig. 6—Diagram of Wheatstone Bridge Arrangement.

ratio of the current $c$ through the galvanometer $G$ to the current $C$ through the resistance $R$ to be measured is a measure of the sensitiveness. This ratio is quite independent of the resistance or e.m.f. in the battery circuit. In order not to reduce the sensitiveness considerably it is of first importance not to make $n$ small or $m$ large. In the practical use of platinum thermometers $n$ must be equal to unity, because it is necessary to compensate the changes of resistance of the leads by the equal changes of resistance of a pair of compensating leads on the opposite side of the galvanometer contact on the bridge-wire; and $m$ is made $= 1$ or less. The author discusses the resistance of the galvanometer and the resistance of the thermometer, and then takes up the construction of clinical thermometers. Quicker action and a smaller heating effect of the current are readily effected by winding the wire on a flat plate of mica in place of a cross, and melting the lower part of the containing tube (which is preferably of lead-glass) down onto the wire so as to form a flat bulb, as illustrated in Fig. 7. If the glass is thin, the sensitiveness may be increased nearly five times, as

compared with a thermometer of the ordinary type, and the heating effect of the current reduced in nearly the same proportion. When inserted in a water bath at 37 deg. C. this thermometer takes less than a minute in arriving within a hundredth degree of the final temperature, but when inserted cold in the mouth it may take four or five minutes to get within a tenth of a degree, because the tissues of the mouth take time to recover from the cooling effect of inserting the thermometer. It is essential that thermometers of this type

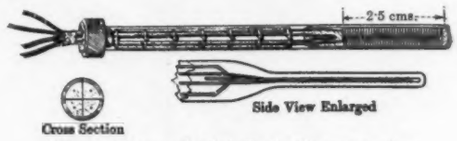



Fig. 7—Form of Flat-Bulb Thermometer.

should be provided with compensated leads, otherwise there will be a variable immersion error, and an apparent lag due to slow conduction of heat along the leads. It is also important for accurate work to avoid screw terminals in the head of the thermometer, and to provide each instrument with flexible leads 2 m or 3 m long, permanently soldered to the thermometer and compensator leads and securely attached to the head of the thermometer, as indicated in Fig. 7. Finally recorders, and especially the thread recorder, are discussed.—Lond. *Electrician*, Sept. 2.

*Measurement of Magnetic Susceptibility.*—P. PASCAL.—A paper presented before the French Academy of Sciences. The solid or liquid body, the magnetic susceptibility of which is to be measured, fills one-half of a glass tube *T* (Fig. 8), which

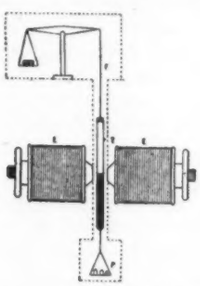


Fig. 8—Measurement of Magnetic Susceptibility.

has a length of 10 cm to 30 cm (4 in. to 12 in.) and an inside diameter of 8 mm (315 mils). By means of a thread *F* of 60 cm or 70 cm (24 in. to 28 in.) length this tube is suspended from one arm of a balance. The tube is in the air-gap of a strong electromagnet. The upper surface of the material to be tested is in the center of the magnetic field, which is practically constant in a volume of 2 cu. cm (0.12 cu. in.) for an air-gap of 1 cm (394 mils). A non-magnetic tray *P* is suspended from the lower end of the glass tube and the whole is protected by means of a glass cage, indicated in the illustration by dotted lines. A horizontal miscroscope permits the observation of the upper surface of the material to be tested. The apparatus is brought into equilibrium by putting weights upon the tray *P*. The weights on this tray are then changed and equilibrium is re-established by exciting the electromagnet. From the excitation of the electromagnet and the change of weights on *P* the magnetic susceptibility is determined.—*La Lumière Elec.*, Aug. 27.

### Telegraphy, Telephony and Signals.

*Telephone Exchange.*—An illustrated description of a new telephone exchange in London which is the first London exchange to adopt a 40-volt common battery in place of the customary 11-cell battery, and it will employ the new circuit introduced by the Peel-Conner Telephone Works at the new Glasgow telephone exchange modified to suit London requirements. The exchange is in Willesden, and is equipped for 2700 subscribers' lines with an ultimate capacity of 8100. There are 208 incoming junctions, 240 outgoing junctions and 40 incoming order wires. Fig. 9 is a drawing of the relay employed throughout the circuits. The armature *A* is hinged in simple manner at *B* and is controlled by the flat brass spring *C*, which is an extension of the connection tab, and also carries one of the contacts. It presses the armature outward through the small ebonite piece *D*, which is fixed to the stirrup *F*. *G* is merely an ebonite distance-piece to keep the lower contact spring *H* in position, and the spring *C* has a hole in it just sufficiently large to allow it to clear *G* as it moves backward and forward. The end of the armature is brought inward and curved to embrace the extension of the core of the coil, and this end of the armature is shod with thin sheet brass to prevent sticking. All the iron parts are galvanized. A conical nut *K* with a lock nut is placed on a set-screw in the brass bracket which supports the coil and core. The stirrup *F* rests

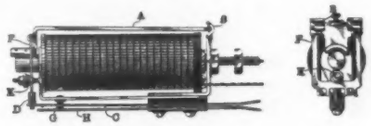


Fig. 9—Diagram of Telephone Relay.

on this nut in its normal position and by turning the nut in one direction or the other a very delicate adjustment is obtained of the distance between the core and the curved projection of the armature. Diagrams are given of the construction of the switchboard and connections.—Lond. *Elec. Eng'ing*, Sept. 1.

*Wireless Telegraph Station.*—A. TOSI.—An abstract of a paper read before the International Society of Electricians in Paris. The author describes the new wireless telegraph station at Boulogne, where the Bellini-Tosi directive system is employed. The results obtained as regards communication are stated to be excellent, messages having been regularly exchanged at night between Boulogne and Algiers, a distance of 1500 km (900 miles), using only ½ kw of primary energy at Boulogne. It has been found that in all cases the signals received on the directive system—which is not earthed—are considerably stronger than those of the ordinary system. Some quantitative experiments made with a Duddell thermogalvanometer at a distance of 3 km (1¾ miles) from the station showed that, using the directive aerial, the deflection obtained is practically six times (113:19) as great as with the ordinary vertical antenna (earthed). The concluding portion of the paper makes mention of the use of the radiogoniometer ("wireless azimuthal compass") on board ship for position finding. In the course of a voyage to New York and back on the *Louisiane*, of the Compagnie Générale Transatlantique, which was fitted with a temporary compass installation, it was proved that the useful range of the wireless compass was at least equal to that of the standard compass—namely, about 40 km (24 miles). The bearings of several wireless telegraph stations as determined with the wireless and the standard compass were always identical. The important point was also established that the elevated metal parts of the vessel have no influence whatever on the bearing as determined with the wireless compass. The use of such a compass in time of fog is obvious, and is still further increased if a land station fitted with the directive method is available within range.—Lond. *Electrician*, Sept. 2.

*Telephone Transformer.*—H. PLEIJEL.—An article in which the author gives formulas for the self-induction and the most favorable number of turns in the windings of a transformer for telephone currents. A simple graphical solution of the problem is given.—*La Lumière Elec.*, Aug. 27.

*Wireless Telephony.*—The first part of a review of the various papers and notes presented by Majorana to the Reale Accademia dei Lincei in Rome on wireless telegraphy and telephony. In the present instalment the different methods of the production of sparks and the regulation of sparks are discussed.—*La Lumière Elec.*, Aug. 20. In the concluding in-

stalment hydraulic microphones are especially dealt with and the principal arrangements used by Majorana in practice in the transmitting and receiving stations are described.—*La Lumière Elec.*, Aug. 27.

*Wireless Telegraphy.*—W. H. Eccles.—The first part of an article illustrated by diagrams on recent patents in wireless telegraphy. The author first deals with methods of generating oscillations and then discusses methods of producing signals. The article is to be concluded.—Lond. *Electrician*, Sept. 2.

**Miscellaneous.**

*Electro-Vaccination.*—The fact that a variety of skin diseases, such as psoriasis, lupus and eczema, show material improvement under exceedingly small doses of X-ray radiation has led to the view, put forward recently by Dr. W. Deane Butcher, and reported in the *Archives of the Röntgen Ray*, that the action of irradiation is of the same nature as that of vaccination—that is, it furnishes a stimulus under the influence of which the patient's own organism develops the equivalent of a vaccine. For example, the irradiation of a leg for lupus has been followed by improvement in a remote part of the body, such as the face; acne of the face has been cured by X-rays and high-frequency treatment applied to the back and shoulders; and numerous cases are on record in which remarkable results have been obtained from comparatively trifling applications of the treatment. Dr. Butcher remarks that "in the whole purview of medicine there is nothing more impressive or more certain than the cure of a small rodent ulcer by electrical methods"; but it may be effected in many ways—Röntgen rays, radium, ultra-violet light, high-frequency effluves, or zinc ions. The common factor in all these cures is, he thinks, "a biological recoil—the resentment of the cells of the organism to the insult of the ethereal vibration," resulting in the production of antitoxins or other antibodies. "It is a true vaccination."—Lond. *Elec. Rev.*, Aug. 26.

*Mathematics.*—E. W. Hobson.—His presidential address to the mathematical and physical section of the British Association for the Advancement of Science. He dealt with the scope and tendencies of modern mathematics. He emphasized that pure mathematics should not be suppressed for the sake of applied mathematics. The belief is very general among instructed persons that the truths of mathematics have absolute certainty, or at least that there appertains to them the highest degree of certainty of which the human mind is capable. Nevertheless there are two facts which are of considerable importance as regards an estimation of the precise character of mathematical knowledge. In the first place, it is a fact that frequently and at various times, differences of opinion have existed among mathematicians, giving rise to controversies as to the validity of whole lines of reasoning and affecting the results of such reasoning. In the second place, the accepted standard of rigor, that is, the standard of what is deemed necessary to constitute a valid demonstration, has undergone change in the course of time. That oldest text-book of science in the world, Euclid's elements of geometry, has been popularly held for centuries to be the very model of deductive logical demonstration. Criticism has, however, largely invalidated this view. The author questioned the success of the new school of teaching mathematics in English technical schools. "It is quite true that a great mass of detail which has gradually come to form part—often much too large a part—of the material of the student of mathematics may with great advantage be ignored by those whose main study is to be engineering science or physics. Yet it cannot be too strongly insisted on that a firm grasp of the principles, as distinct from the mere processes, of calculation is essential if mathematics is to be a tool really useful to the engineer and the physicist." In a separate editorial article the deplorable lack of mathematical training among engineering students, especially in evening schools, is discussed. The most serious is the inability to manipulate simple equations, and it is recommended "to keep the class working at the manipulation of simple equations for no less a period than three months." The second weakness is the inability to calculate the arithmetical part when the question has been brought to suitable form, and to use logarithms and the slide rule efficiently.—Lond. *Elec. Rev.*, Sept. 2.

# Book Reviews

Freight Transportation on Trolley Lines. By Charles S. Pease. New York: McGraw-Hill Book Company. 62 pages, illus. Price $1.

Freight is the principal source of income for steam roads and yet the electric lines have been very slow to take up this branch of the transportation business. Of course, electric roads usually operate only short lines and have no facilities for handling regular freight business, yet a local freight and express business can often be profitably developed if taken up in a thorough-going manner. Mr. Pease has outlined the essentials of local freight business, and laid down simple rules to guide those who desire to establish such a business. It is a book which all electric interurban railway managers can read with profit.

Manual of Wireless Telegraphy. For the Use of Naval Electricians. By Lieut-Comdr. S. S. Robison. Annapolis: U. S. Naval Institute. 129 pages, 60 illus.

This is one of a series of books on various subjects compiled to serve as manuals for those engaged in carrying on the routine work of the various naval technical branches to which they relate. The present book contains five chapters and a number of appendices, as follows: Chapter I consists of a general review of facts relating to high-frequency currents, prefaced by a statement of the fundamental principles of electrical action. Chapter II relates specifically to high-frequency phenomena, with sections on condensers, skin effect, and electric waves. Chapter III is on damped and undamped oscillations. Chapters IV and V are devoted respectively to sending and receiving circuits. The three final chapters have in this edition (1909) been revised and extended by Dr. L. W. Austin. The appendices include several sets of official instructions for the installation and operation of wireless plants, regulations, keeping of log-books, etc. The book is of general interest as an epitome of the principles of wireless telegraphy and as a guide for the practical operation of plants. It cannot, however, be considered a systematic treatise on either the science or the art.

Medical Electricity and Röntgen Rays. With Chapters on Phototherapy and Radium. By Sinclair Tousey, A.M., M.D. Philadelphia: W. B. Saunders Company. 1116 pages, 734 illus. Price, $7.

In this substantial volume the author has brought together a vast amount of information not only on medical electricity and the X-ray, but also on the treatment of disease by electric light and radium. Considerable space is given to the physics of electricity in its bearings on medicine and to a description of the great variety of apparatus in use. There are full discussions of the physiologic effects of electricity; of electropathology; electrodiagnosis; ionic medication by electrolysis; the physiologic effects of electromagnets; electricity in diseases of the nervous system; and of high-frequency currents. Equally exhaustive are the chapters that deal with phototherapy, the Röntgen rays, radium and radium therapy. The work is so encyclopedic in scope that there is scarcely a topic relating to medical electricity for which the reader will look in vain among its pages. On this account it should prove a useful book of reference. As a text-book for the student and practitioner wishing to acquire a systematic and serviceable knowledge of medical electricity and light therapy it appears to be open to two objections, namely, the lack of perspective evinced in the author's treatment of some of the sections, and the tendency—natural, perhaps, in a work of this kind—to overrate the curative power of the agents with which it deals.

MACHINE SHOP DRAWINGS. Reading Drawings, Making Shop Sketches, Laying Out Work. By Fred. H. Colvin. New York: McGraw-Hill Book Company. 146 pages, 91 illus. Price, $1.

This little book may be considered as an exposition of the language of mechanical drawing which will enable any ordinary mechanic to interpret shop drawings, to lay out simple work involving geometrical relations and to make intelligible perspective sketches to assist him in conveying his ideas. Mr. Colvin has drawn all his examples from practice and his explanations are clear and to the point. For those who wish merely an elementary knowledge, this book is suitable.

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PRACTICAL TESTING OF ELECTRICAL MACHINES. By Leonard Oulton and Norman J. Wilson. New York: The Macmillan Company. 210 pages, 90 illus. Price, $1.40.

The commercial testing of alternating-current and direct-current machines is here stated in the form of directions for making tests, working up the data and tabulating the results. The theory of the machines and of the tests is presupposed and is therefore not given. On account of the absence of all theory and reasoning, the book is not adapted to use alone, but should be studied in conjunction with other books. For those who have testing to do the book furnishes plain directions for making all the ordinary tests. The authors evidently do not consider the various loading-back tests as sufficiently common for presentation in this book, and it is probable that in England this may be true. American readers will consider this as a serious omission. Transformer testing is not treated.

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THE GAS TURBINE. By H. H. Supplee. Philadelphia: J. P. Lippincott Company. 262 pages, 93 illus. Price, $3.

The present work collects and arranges for study and reference the principal contributions that have been made to the subect of the gas turbine. After a brief historical sketch, Neilson's paper entitled "A Scientific Investigation Into the Possibilities of the Gas Turbine," read before the British Institution of Mechanical Engineers in 1904, is given in full, together with its subsequent discussion by members. This paper occupies a fourth of the book, and is of considerable value from a theoretical standpoint, as a great variety of cycles for the use of the heat in a cubic foot of gas mixture are worked out theoretically for maximum ideal efficiencies. One of the conclusions is that the best results in gas turbines will come, not necessarily from high temperatures, but with moderate temperatures and careful dispositions to obtain the least possible negative work.

The next section of the book consists of a paper by M. Sekutowicz, read before the French Society of Civil Engineers. The entire range of theoretical and practical possibilities in connection with the gas turbine is here discussed in the clear, logical French style, so pleasing to those surfeited with "engineering English." It is interesting to note that one of the very cycles pronounced by Sekutowicz to be singularly capable theoretically of efficient service—namely, the use of waste explosion and exhaust heat gases to generate steam to be also directed upon the turbine blades for the double purpose of increasing the potential volume available from the total heat and also cooling the turbine blades themselves—should have been the actual practical scheme adopted by later experimenters.

The next two chapters of the book are devoted to theoretical considerations of expansion nozzles and turbine blades, and the final chapters give the experimental researches of Armengaud, Stelzer, Lemale, Rateau and Barbezat up to the death of Armengaud in 1908. It appears that up to the death of Armengaud considerable progress had been made, including the construction of a 300-hp gas turbine, which developed that amount of power over and above the negative work required by the air compressor, which was about half the load.

At present effort to produce a practical gas turbine is centered on two types. One is the constant-combustion type in which compressed air and gas are brought together in a suitable chamber and the resulting expansion from ignition directed upon the blades of a turbine wheel through a divergent nozzle. A steam nozzle also acts upon the same wheel, keeping down the temperature and getting its steam from a flash boiler in the path of the exhaust gases from the turbine wheel.

The second type is the explosion turbine, in which air is admitted at atmospheric pressure into the explosion chamber, meets a charge of gas, is ignited and directed upon a turbine wheel by a nozzle. The force of the explosion not only empties the chamber, but produces a suction that draws in another charge of air, which ignites after mixture with the gas, about three explosions to the second occurring. Even in its present crude state the small explosion turbines, such as Kravodine's, are stated to give about the same economy as a gas engine. For those interested in the development of the gas turbine this book will be of great value.

# New Apparatus and Appliances

## TUNGSTEN LAMP IMPROVEMENT.

The member companies of the National Electric Lamp Association have begun to supply, in limited quantities, a new form of "Mazda" lamp, developed in the laboratories of the Association, which, it is claimed, is one of the most important advances yet made in the development of the incandescent lamp. It is stated that the principal point which distinguishes the newcomer from its predecessors is the method of making and mounting the filament, which is produced in the form of a long ductile wire, by means of processes said to be unlike any of those hitherto employed in the manufacture of tungsten filaments. Lamps made from this wire have continuous as distinguished from non-continuous, or "hairpin," filaments.

The connection between the wire filament and the leading-in wires is made by means of a "clamped joint' similar to that used in tantalum lamps. Such a joint is more or less flexible, and it is therefore evident that all rigid points of filament attachment have been eliminated. It is stated that the lamps made from the newly developed wire will stand without damage a blow from two to four times as severe as will an ordinary tungsten-filament lamp. The wire as manufactured at present is ductile and flexible but becomes less ductile after the lamp is first lighted. The increased strength is mainly due to the improved method of support, as explained above. The present lamp is stated to be made by a radically different process from that employed for other "wire type" tungstens and not to possess the objections which have been noted against the latter. In fact, the new lamp is said to be practically equal to the present "Mazda" as regards life and candle-power performance, to which is added its freedom from fragility.

The following manufacturers are selling the new lamps: The Banner Electric Company, the Brilliant Electric Company, Bryan-Marsh Company, the Buckeye Electric Company, the Colonial Electric Company, the Columbia Incandescent Lamp Company, the Fostoria Incandescent Lamp Company, the General Incandescent Lamp Company, the Monarch Incandescent Lamp Company, New York & Ohio Company, the Shelby Electric Company, the Standard Electrical Manufacturing Company, the Sterling Electrical Manufacturing Company, the Sunbeam Incandescent Lamp Company and the Warren Electric & Specialty Company.

## THEATER DIMMER.

The accompanying illustrations show side and front views of a bank of dimmers furnished the Hollis Street Theater, Boston, by the Ward Leonard Company, Bronxville, N. Y. One of the main features of the dimmer is that the absolute

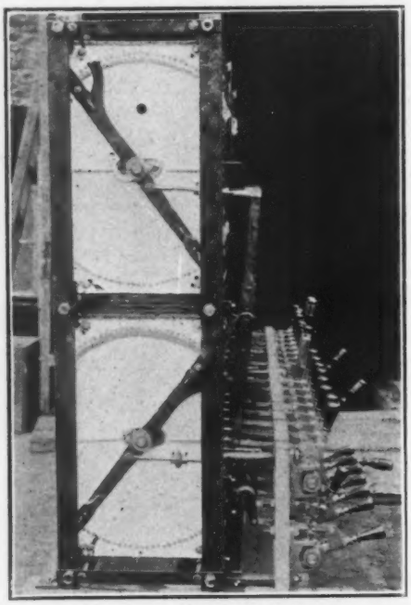


Fig. 1—Side View of Dimmer.

direct drive given between the operating handle and the controlling lever is maintained upon a straight line even though the plates are of a considerable height above the board. This obviates the cutting of a large slot in the switchboard and assures a perfectly smooth dimming of the lights. The operation

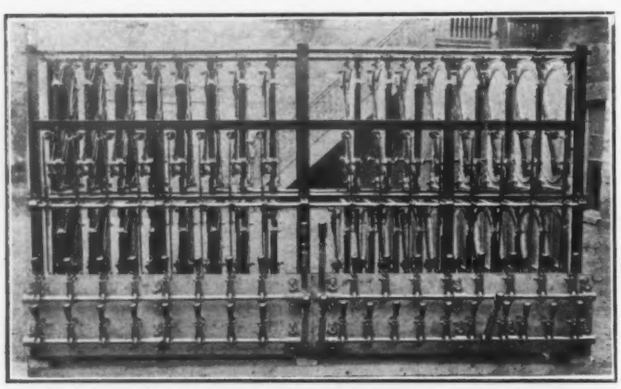


Fig. 2—Front View of Dimmer.

is self-explanatory from the cuts. It may be added that these dimmers are so nicely balanced in operation that any dimmer handle can be used to control the entire dimmer bank, it not being necessary to use a large handle as a master lever. The plates are of the standard enamel type.

## TUNGSTEN ROSETTES.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has put on the market a rosette for use with tungsten lamps and shown in the accompanying illustration. As will be seen, the laminated cotton felt cushion takes the support off the lamp and eliminates vibration of the tungsten filament. This device will thus allow tungsten lamps to be used in factories and lofts where otherwise they could not safely be installed. As is well known, the life of a tungsten lamp will be greatly prolonged when a suitable shock absorber is used, especially in installations where lamps are subjected to more or less severe vibration. The manufacturers state that in spite of the fact that mechanically the construction of tungsten lamps has been considerably improved, their filaments are still fragile,

Tungsten Rosette.

but that the new rosette will enable their use in all places where the lamps are subject to vibration.

## BENJAMIN REFLECTOR SOCKETS.

A line of reflector sockets is being placed upon the market by the Benjamin Electric Manufacturing Company, of Chicago. They consist of a deeply-hooded, one-piece, enameled-steel reflector with a threaded brass bushing tightly clamping the reflector between two leather washers and an especially designed

Fig. 1—Bowl-Shaped Reflector with 100-Watt Tungsten Lamp.

receptacle or socket. The reflectors are of two general types—flat-cone (distributing), for wide distribution, and bowl-shaped (diffusing), for medium distribution. The hooded portion varies in diameter to accommodate three kinds of lamps, namely, carbon and short base, skirted base and large base. Each

Fig. 2—Flat-Cone Reflector with 500-Watt Tungsten Lamp.

type of reflector is designed for use with a definite range of lamps and with particular regard for the correct relation of lamp filament and reflecting surface. The present device meets the demand for fixtures permitting the use of large base, i. e., 400-watt and 500-watt metallic-filament lamps.

# Industrial and Commercial News

### THE WEEK IN TRADE.

REPORTS from commercial trade and the industries were rather more irregular last week than for the past month, and there seems to be some falling off in actual trade. The first rush of fall buying is over in many sections, and the wholesalers and jobbers are therefore taking fewer orders than during the first two weeks of the month. Throughout the country state and county fairs and other festivals are stimulating retail trade to some extent. Reports from the West are still more optimistic than those from manufacturing centers. The early marketing of the cereal crops and the unusually high prices received are furnishing an abundance of ready money to purchasers. The cotton-crop movement is expanding, especially in the Southwest, and this is having a beneficial effect upon retail trade and upon collections. Reports from leading industries show that there has been rather less expansion than was anticipated. Curtailment is still in evidence in all of the leading textile industries, although the mills are operating more fully than in midsummer. Pig iron is somewhat quieter, but producers report that there are a number of inquiries received from abroad and prices show no inclination to decline. In finished lines in the iron and steel trade specifications on previous contracts are good, and the plants as a rule are operating from 65 to 80 per cent of capacity. New business, however, is not coming in at a rate of better than 50 per cent of capacity. At the end of August the United States Steel Corporation had on its books orders for 3,537,128 tons, a decrease of almost half a million tons from the end of July, and a decrease of 2,389,903 tons, or more than 40 per cent, from the beginning of the year. On some heavy lines prices are being cut, in many instances amounting to $1 per ton. The most active demand for finished goods is for steel wire. Collections are somewhat better, owing to the free supply of money throughout the Western country. Failures for the week which ended Sept. 15, as reported by *Bradstreet's*, were 210, as against 173 the previous week, 198 in the same week of 1909, 266 in 1908, 197 in 1907 and 171 in 1906.

### THE COPPER MARKET

THERE was so little doing in the copper market last week that review is hardly worth while. Although there was a weaker tone developed and prices were somewhat lower, there was so little actual business that quotations must be regarded as nominal. Through agreements between domestic and foreign selling agencies it is not a difficult matter to fix a basis beyond which concessions will not be made. As long as a controlling amount of copper is included in these agreements the price of copper will fail to represent any condition of supply and demand. The real, cold-blooded situation is that the producers, according to the latest reports, are bringing forward an unprecedentedly large amount of copper and the actual consumers, both in this country and Europe, are using less than they did a few months ago. The continuance of such a condition must mean the accumulation of a surplus in spite of the fact that the figures of the last report of the Copper Producers' Association showed a decrease in stocks. Reports from all electrical manufacturers and brass founders since the first of the current month are to the effect that business is not as active as had been expected and that in consequence less copper was being melted. In foreign countries the consumption is a trifle better, but is not up to that of the flush times a few years ago. Imports have been somewhat less since the first of the month and exports have been at about the same ratio. The total exports for September, up to and including Sept. 19, were 17,699 tons. The daily call on the Metal Exchange Sept. 19 was as per accompanying table.

| Standard Copper. | Bid. | Asked. | Settling price. |
|---|---|---|---|
| Spot | 12.10 | 12.20 | ..... |
| September | 12.10 | 12.20 | 12.15 |
| October | 12.10 | 12.20 | 12.15 |
| November | 12.15 | 12.20 | 12.17½ |
| December | 12.15 | 12.22½ | 12.20 |

The London market Sept. 19 was as follows:

| | Noon. £ s d | Close. £ s d |
|---|---|---|
| Standard copper, spot | 54 15 0 | 54 17 6 |
| Standard copper, futures | 55 10 0 | 55 11 3 |

Extreme fluctuations for this year:

| | Highest. | Lowest. |
|---|---|---|
| Standard | 13.50c | 11.70c |
| London, spot | £62 0 0 | £52 15 0 |

### INDUSTRIAL AND COMMERCIAL NOTES.

**Hugo Reisinger Says Germany Is Busy.**—Hugo Reisinger, the importer of lighting carbons and other electrical specialties, returned from Europe last week, where he has been spending several months. He says that he found conditions abroad somewhat better than they are in this country, and this was especially true in Germany. In France and England unusually inclement weather has done much to retard the crops, and especially in France there is some feeling of discouragement. While the season in Germany has been colder, with more rain than usual, it has not seriously interfered with business. The big electrical concerns, he said, were all fairly busy, and the export trade was very satisfactory. The Bergmann factory, he said, was running full time and was now the third largest electrical manufacturing concern in the empire. Mr. Reisinger said he noted that since his trip the year previous there had been a great increase in the use of flaming-arc lamps for street lighting. In almost every city and town this kind of lamp was supplanting the old enclosed arc. He also said that Germany had practically abandoned the use of carbon-filament lamps; that the tungstens were used exclusively in house lighting, and that on every train in Germany all of the lighting is done by tungstens. Mr. Reisinger spent most of his time motoring over the Continent and through England and Scotland.

**Allis-Chalmers Activities in Chicago.**—Since the removal of the general offices of the Allis-Chalmers Company from Chicago to Milwaukee several years ago, President Whiteside has maintained offices in both cities, making his Milwaukee office, however, his main headquarters. Several months ago David Van Alstyne, formerly vice-president of the American Locomotive Company, was elected vice-president of the Allis-Chalmers Company, in charge of the manufacturing department, with headquarters at Milwaukee. This accession to the company will permit President Whiteside to devote more of his time to the larger interests of the company, which will require him to spend a greater portion of his time than heretofore in Chicago and New York. While continuing his Milwaukee office, it is probable that Mr. Whiteside will make his headquarters largely at the Chicago office of the company, which is in the First National Bank Building.

**Southern Power Company.**—After three years of investigation and experimentation, the Southern Power Company has let a contract for the installation of a 4000-hp plant for the production of nitrates by an electrochemical process. This plant will be used largely for experimental purposes, and will be located near the Great Falls power station of the company in South Carolina. It is said that a second plant of 24,000 hp is in contemplation, but the site has not yet been chosen. The Southern Power Company has purchased the "Geneva" process of converting the nitrogen of the air into nitrates suitable for soil fertilization, and has also developed a newer and, it is claimed, better process. It is said that as soon as these plants are completed the company will turn its attention toward inducing the large farmers of the Piedmont section to install private plants for the manufacture of their own fertilizers.

**Berlin (Ont.) Lighted by Water Power.**—The town of Berlin, Ont. is now illuminated with electric energy generated at Niagara Falls. The new system began operation last week. The formal test at the new municipal transformer station was made two weeks ago and proved satisfactory. The entire plant, including the transmission lines, is municipally owned. The power is transmitted at from 110,000 volts to 130,000 volts to the transformer station, where it is stepped down to 13,200 volts to the town's plant, where it is again transformed to suit local conditions—550 volts for street railway purposes, and 500 volts for street arc lamps.

**Insulated Wire Trade Depressed.**—One of the principal manufacturers of insulated wire says that since the first of August the demand for this material has been very spasmodic and business has been very slow. A few orders have been received, but there has been no steadiness to the business and few specifications have been filed for future orders. This authority says that while there has been a great deal of building in cities during the past season, it has been to a large degree the construction of loft buildings instead of the construction of hotels and office buildings. He pointed out that loft buildings require very much less wiring than the other classes. "Our business," said he, "has been badly complicated for several reasons. In the first place, the three commodities which are used, copper, rubber and cotton yarn, have all been uncertain in price, which has made it extremely difficult for the manufacturer of rubber-covered wire to figure his factory cost. Rubber has been at the highest point in its history and has fluctuated violently. Just at the present moment Para rubber is selling at about $1.80, as compared with $3 a month or so ago. Copper, while the price has not been high, has been in a state of uncertainty, owing to over-production and manipulation, that has kept us always uneasy, while cotton yarns have been unsettled to an absolutely unheard-of degree. The result of these markets has made it almost impossible for the manufacturer to figure in advance upon a job of work. Another point that has seriously interfered with us is the entrance into the field of half a dozen manufacturers of cheap and, we think, unsatisfactory goods. By using substitutes and compounds these manufacturers have made a class of material that can be sold at far less than our cost of production. No concern with any reputation can afford to put on the market this class of insulated wire, although, of course, we could make it if we wanted to. The competition of these manufacturers has seriously disorganized our business. It is said that the building authorities of the city of New York, in conjunction with the underwriters, are now considering a new set of specifications which we hope will eventually bar out all inferior materials."

**Western Electric Company's Business.**—The report of the business of the Western Electric Company for the first nine months of its fiscal year which ended Aug. 31 shows a continuation of the heavy gains which had been previously recorded and shows no occasion to revise the former estimate of a total business for the year of something like $61,000,000. The gain in August was about 50 per cent over the same month last year. The main business of the company has been in the line of telephone apparatus and it is given out by the company that at the present time more than 7000 telephone companies are purchasing its supplies. The present year's business will be divided among approximately 800,000 orders as compared with 475,000 in 1906, with an average value per order of $71 for 1910, as compared with average value of $145 in 1906. The business is coming from all sections of the country, indeed from all parts of the world. Export business is showing gratifying increases. On the Western Electric's payroll there are at present 23,000 persons. In line with its policy of concentrating the manufacturing in its new Hawthorne works, and in order to provide adequate manufacturing facilities for the future, it is now planned to erect further extensions to the buildings at Hawthorne. In this connection it is announced that two properties belonging to the company have been placed upon the market for sale. One of these is located on the Chicago River, in the heart of Chicago, and is now covered by ten buildings used as warehouses, and the other practically covers two blocks in the downtown district of Chicago. This plot was formerly occupied by manufacturing plants which have now been transferred to Hawthorne. The company will retain at this point ample space for distributing purposes. The balance sheet of the company, as of March 1, 1910, recently submitted to the Stock Exchange, shows total assets of $60,306,000, which include $2,113,000 cash and $21,331,000 bills receivable.

**Victor Electric Company.**—The Victor Electric Company of Chicago has certified an increase in its capital stock from $16,100 to $330,000. A part of the proceeds is to be used for the purchase of ground and the erection of a four-story factory building in the neighborhood of Jackson Boulevard and Robey Street to have about 50,000 sq. ft. of floor space. This factory will give the company a little more than double the floor space now available in its quarters at 55-61 Market Street. The greater part of the increase was issued in common stock because of the fact that the company has accumulated a surplus out of proportion to its original capitalization. None of the stock, either preferred or common, is for sale, all of it having been subscribed by stockholders of record at the time the increase was made. The Victor Electric Company manufactures electrical machinery and electrically driven air compressors. C. F. Samms is president and manager and J. B. Wantz is secretary and superintendent.

**August Business of the Electrical Companies.**—Practically every one of the large electrical manufacturing companies reports a falling off of business during the month of August compared with previous months. This is the first decrease that has been reported for some time past, as the tendency of new orders has been upward since the beginning of the year. One of the reasons advanced for the shrinkage of business in August is the falling off in new construction work by railroads and traction companies. A notable exception to the decline in business is the demand for household appliances. Just at the present time this is greater than ever before, and from every part of the country, especially the Far West, there are inquiries for all kinds of domestic apparatus. A large part of this business is to supply the Christmas trade, which is heavy in this class of goods.

**Hoosac Tunnel Electrification.**—Officers of the Boston & Maine Railroad have confirmed the report that a plan has been matured for the electrification of the Hoosac tunnel. Since Charles S. Mellen has taken active charge of the railroad this is one of the first improvements that will be looked after. Mr. Mellen has given considerable attention to this matter and has had reports from engineers upon the subject. He has decided that the abolition of the smoke nuisance is imperative and, according to estimates made, electricity can be substituted for steam in this section at a cost not exceeding $1,000,000, including the cost of electric locomotives. When the changes are completed it is said that both passenger and freight trains will be taken through the tunnel from Tunnel Station, on the east, to North Adams and possibly to Williamstown, on the west, by electrical energy.

**Electrical Construction.**—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Herington, Kan.; Covington, Ga.; Victoria, B. C., Can.; Covington, Va.; Swift Current, Sask., Can.; Fairmont, Minn.; Edenton, N. C.; Cochrane, Ont., Can.; Skowhegan, Maine; Placerville, Cal.; Portland, Ore.; Red Hook, N. Y.; Washington, D. C.; Worcester, Mass.; Eldora, Ia.; Superior, Wis.; Chicago, Ill.; Pasadena, Cal.; Batesville, Ind.; Atlanta, Ga.; Hazen, Ark.; Centerville, Mich., and Marcus, Wash.

**Chicago Telephone Company.**—The Chicago Telephone Company installed 4709 new telephones in August and removed 2339, making a net gain of 2370. For the eight months which ended with August 45,960 new instruments were installed, as compared with 39,884 in the same period last year. The total number of telephones in service in Chicago and its suburban districts at present is 285,691, an increase of 14.9 per cent. The earnings of the company are at the present time increasing rapidly, and are larger than at any period in its history.

**Garwood Electric Company.**—The Garwood Electric Company reports that there has been an unusually large business during the past few months in welding equipments. Orders for this line of business have been heavier than at any time in the history of the company. Other lines of business are also fairly active, although during August orders were not as plentiful as earlier in the season. The shops at the present time, however, are as busy as at any period since the company was formed and as many workmen are employed.

**Westinghouse Air Brake Company.**—An official of the Westinghouse Air Brake Company is authority for the statement that this fiscal year will be one of the best since the company was formed. Equipment purchases by the railroads for passenger service broke all records on account of the replacement of wooden cars by steel cars on many Eastern lines. At the present time, according to this authority, orders for complete equipments are not so plentiful, but repair work is very active.

# Financial.

## THE WEEK IN WALL STREET

CONSIDERABLE surprise was expressed in Wall Street last week that the stock market showed increased activity and advanced prices immediately upon receiving the returns from the Maine election. The presumption was that a Democratic victory would have a depressing effect. The reverse was the case. As a matter of fact there was no politics at all in the market. There is at the present time in Wall Street nothing political that is giving rise to any serious emotions. The trouble with the Street is "general apathy" or general lack of business. The spasmodic trading, accompanied by increased prices which occurred in the early part of last week, meant nothing except that a few gamblers were willing to take a chance that the days of stagnation were over. The total course of the market during the entire week showed no improvement in price. While the total sales were almost twice the previous week they were almost all traceable to professionals. Traders whose only living depends upon transactions in the market must necessarily keep on trading. The result of the entire week's transactions was that the market ended not very different from the way it began and that the active issues showed only fractional changes. The principal practical feature of the week was the announcement that Phelps, Dodge & Company had taken over the heavy line of Rock Island stock being carried by the Pearson-Farquhar syndicate. This stock had been a menace to the market for many weeks, as it was well known that the syndicate could not care for it and there was the constant danger that it might be used as a club to further a bear raid. There is now no danger of a long line being forced upon a sensitive and weak market. There was no improvement worthy of note in the bond market during the week. Bond prices are not depressed, as might be expected under the circumstances, but they show no inclination to go higher. Transactions are very light and only the best known issues seem to have any call. Money remains distinctly easy for call loans, although time loans are not phenomenally cheap. Quotations Sept. 19 were as follows: Call, 1½@2 per cent; 90 days, 4¼ per cent. The quotations in the table are those of Sept. 19, 1910.

NEW YORK.

| | Sep. 12. | Sept. 19. | Shares sold. | | Sep. 12. | Sept. 19. | Shares sold. |
|---|---|---|---|---|---|---|---|
| All.-Ch. .... | 8½* | 8¼* | 235 | Int.-Met., pfd | 49¼ | 54⅝ | 60,600 |
| All. Ch., pfd. | 31* | 30* | 600 | Mackay Cos. | 90⅜* | 89⅝* | 300 |
| Amal. Cop... | 63¾ | 63⅜ | 67,120 | Mackay, C.,pf. | 75* | 73⅝ | 107 |
| Am. D. T.... | 20½* | 20½* | ——— | Man. Elev.... | 131 | 134¼ | 1,000 |
| Am. Loc.... | 36½* | 37 | 900 | Met. St. Ry.. | 15* | 15* | ——— |
| Am.Loc.,pfd.. | 105 | 106* | 210 | N.Y.&N.J.Tel. | 139¼* | 139¼* | ——— |
| Am. Tel. & C | 71¼* | 71¼* | ——— | Steel, com... | 68⅝ | 67⅝ | 503,600 |
| Am. T. & T.. | 135 | 135 | 4,100 | Steel, pfd... | 116½ | 115½ | 3,260 |
| B. R. T..... | 73¾ | 74⅞ | 22,164 | W. U. T.... | 63* | 64½ | 1,800 |
| Gen. Elec.... | 141⅝ | 142½ | 1,400 | West'h, com. | 59* | 60½ | 900 |
| Int.-Met .... | 18⅛ | 20⅝ | 83,070 | West'h, pfd.. | 110* | 110* | ——— |

PHILADELPHIA.

| | Sept. 12. | Sept. 19. | | Sept. 12. | Sept. 19. |
|---|---|---|---|---|---|
| Am. Rys..... | 43¼* | 43 | Phila. Elec..... | 15⅛ | 15⅝ |
| Elec. Co. of A..... | 11⅜* | 11⅜* | Phila. R. T..... | 18¼ | 17⅝ |
| Elec. St. B'ty..... | 48 | 48⅜ | Phila. Trac..... | 84* | 81¾ |
| E. S. B'ty, pfd..... | 30* | 30* | Union Trac..... | 43¼ | 42¾ |

CHICAGO.

| | Sept. 12. | Sept. 19. | | Sept. 12. | Sept. 19. |
|---|---|---|---|---|---|
| Chi. City Ry..... | 180* | 180* | Chi. Tel. Co..... | 118* | 118½* |
| Chi. Rs., Ser. 1.... | 70* | 65* | Met. El. Co..... | 19* | 19* |
| Chi. Rs., Ser. 2.... | 12¾ | 13¾* | Met. El., pfd..... | 61½* | 62* |
| Com. Edison..... | 111½ | 111 | Nat'l Carbon..... | 120 | 123 |
| Chi. Subways..... | 4¾ | 4¾* | Nat'l Car., pfd..... | 120* | 120* |

BOSTON.

| | Sept. 12. | Sept. 19. | | Sept. 12. | Sept. 19. |
|---|---|---|---|---|---|
| Am. T. & T..... | 135⅛ | 135 | Mex. Tel..... | 5¼* | 5* |
| Cum. Tel..... | 144½* | 144½* | Mex. Tel., pfd..... | 6¼* | 6¼* |
| Edison E., Ill..... | 257⅛ | 256* | N. E. Tel..... | 130½* | 130 |
| Gen. Elec... | 141⅝ | 142½* | 1,400 | W. T. & T..... | 15* | 15 |
| Mass. E. Ry..... | 17¾* | 17¾* | | W. T. & T., pfd.... | 83* | 83* |
| Mass. E. Ry., pfd... | 81¾* | 81½* | | | | |

*Last price quoted.
Shares sold for week Sept. 12 to Sept. 17.

## FINANCIAL NOTES.

**Montreal Street Railway & Power Merger.**—A new phase in the power and street railway situation at Montreal has been given by the announcement at Montreal on Sept. 15 that an arrangement had been entered into between the directors of the Montreal Street Railway and the Montreal Light, Heat & Power companies to join forces in an attempt to prevent the Canadian Light & Power Company from obtaining control of the Montreal Street Railway Company at the coming annual meeting of shareholders of the railway company in November. Following the announcement came large buying orders on the Montreal stock exchange for shares of the Montreal Light, Heat & Power Company, which caused a rise in the price of ten points to the record price of 145. It is claimed that an amalgamation of the Montreal Street Railway and the Montreal Power companies can be effected. Those who are back of the latest proposal claim that they can offer the shareholders of the Street Railway a much better proposition than can the Canadian Power interests. So far as can be learned, it is proposed by the interests concerned in the projected amalgamation of the Street Railway and Montreal Power companies to take in the Street Railway stock at $250 per share and the Power stock at $180 to $190 per share. The present market price of the railway stock is 244, paying a dividend of 10 per cent, while the price of Power stock is 144, on which a dividend of 7 per cent is being paid.

**American Power & Light Company.**—The American Power & Light Company, of New York, has purchased stock control of the Hanford Irrigation & Power Company, which owns a plant and valuable water rights at Priest Rapids, on the Columbia River, in Grant and Yakima Counties, Washington. There are vast power possibilities at this point, of which the Hanford company owns only a small portion. The main business of the Hanford company is pumping water for irrigation of large tracts of arid lands which belong to the company. Two large irrigating ditches have been constructed for the distribution of the water, and lands are being sold to settlers with water rights. The American Power & Light Company already possesses considerable holdings in Washington and Oregon. Last summer it incorporated a subsidiary company, the Pacific Power & Light Company, with a capital of $7,500,000, to take over and operate properties in Eastern Washington and Northeastern Oregon.

**Austin (Tex.) Dam.**—The Hydraulic Properties Company of New York is considering a proposition to take over the contract made by J. C. Dumont with Austin for the erection of a dam across the Colorado River. An electrical engineer has made an examination of the proposed site and other conditions and C. Frank Doebler, secretary of the company, has also made an investigation of the proposition. If the Hydraulic Properties Company takes over the contract it is probable that several changes will be made in the plans of the dam. The structure will have fewer gates than the one planned by J. C. Dumont and will have the power house at one end instead of in the center of the dam. The proposed dam, which will replace the one destroyed ten years ago, will cost $1,000,000, will be 65 ft. high and will render available 5000 hp.

**Red Hook (N. Y.) Light & Power Company.**—The Public Service Commission, of the Second District of New York, has authorized the Red Hook Light & Power Company to issue a mortgage for $150,000 to guarantee bonds of like amount and to take over the franchises held by John H. Sharpe in the towns of Germantown, Livingston and Clermont, in Clermont County. Of the new issue $10,000 are to be used to take up the same amount of bonds outstanding and $60,000 to pay for equipment and the construction of new transmission lines.

**Southern New York Power Company.**—The Public Service Commission of the Second District of New York has authorized the Southern New York Power Company, a newly-organized corporation, to issue $24,000 of new stock at par to pay for the property assets and franchises of the Walton Electric Light Company, of Walton, N. Y., and also $2,100 new stock to pay for the property of the Mulkins Electric Light Company, of Walton. The company asked for authority to issue $40,000 new stock.

**Western Union Telegraph Company.**—The preliminary report of the Western Union Telegraph Company for the quarter which ends Sept. 30 estimates the net earnings at $2,000,000, an increase of more than $70,000 over the same quarter last year. The surplus, after the payment of dividends, will be upward of $800,000. The directors have declared the regular quarterly dividend of ¾ of 1 per cent, payable Oct. 15. The annual meeting of the stockholders will be held Oct. 12.

**Century Electric Company.**—The Century Electric Company of St. Louis, manufacturer of alternating-current motors and ceiling fans, announces an increase in its capital stock from $75,000 to $250,000. The increase is made necessary by the growth of the company's business. The officers of the company are: President, James F. Coyle; vice-president, E. S. Pillsbury; secretary, R. J. Russell; treasurer, John Harget.

**Metropolitan Foreclosure Sale.**—The United States Circuit Court has again postponed the sale of the property of the Metropolitan Street Railway Company, of New York City. The new date set for the sale is Nov. 14.

**United Railways of St. Louis.**—Following the announcement last week by the directors of the United Railways Company of St. Louis that the quarterly dividend of 1¼ per cent on the preferred stock would be passed, the price of the stock in the St. Louis market declined 18¾ points. Shares dropped from 57¾ to 39. It was said that the action of the directors in passing the dividend was based on the necessity of taking care of the floating indebtedness of about $1,300,000, which under the depressed market conditions now prevailing it was impossible to fund upon terms favorable to the company. The passing of the dividend will also enable the company to carry out its program of improvements on the property. This large floating indebtedness was mainly incurred by heavy expenditures for construction and new equipment. The reports of the company show that its gross earnings are greater than ever before. The report of the company for the first seven months of 1910 shows a surplus of about $20,000 over fixed charges and the regular dividend requirements. The company is controlled by the North American Company, of New York.

**Mexican Utility Companies.**—Very favorable statements of the earnings of the Mexican Light & Power Company and of the Mexican Tramways Company for July, and for the seven months ending with July, have been given out. In both instances it is shown that the operating expenses for the seven months were lower than for the same period in the year previous, so that the improvement in net exceeds the improvement in gross. In the case of the Mexican Light & Power Company there has been a phenomenal reduction in operating expenses. The operating ratio to gross revenues in July this year was but 24.30, as compared with 80.47 per cent for July last year. It is stated that the new management of the company has put into effect a large number of economies which have resulted in this exceptional reduction. By the consolidation of the operating departments of a number of interconnected companies, the management has been able to save large sums in wages. The increase in the net earnings for the first seven months of the current year is equal to about 6 per cent on the outstanding common stock.

**Chicago Traction Ordinance.**—All hope of obtaining the passage of the Chicago Consolidated-Chicago Railways ordinance before the Council convenes in regular session, Oct. 3, has been abandoned by those who are back of the merger project. It has been announced by the city administration that no special meeting for this purpose will be called by the Mayor. In the meantime the Chicago Railways certificates showed considerable weakness in the market. This weakness, it is said, is due to selling by small holders, who fear that the Consolidated Traction litigation may be long drawn out, and that when it ends there will be a mass of new securities ahead of theirs. It is assumed that the Consolidated Traction lines will pay their way when they are rehabilitated, but the work of putting them in shape will probably extend over many months.

**Kansas City Railway & Light Company.**—The earnings of the Kansas City Railway & Light Company for the year which ended May 31 were the most favorable in the history of that organization. The gross amounted to $7,178,441, and after paying all fixed charges and dividends on preferred there was left a surplus of $637,551. The operating expenses for the year were considerably increased, but this is explained by the management as being due to the liberal expenditures which we made for renewals and repairs. During the year the company has been putting its physical property into the best possible shape.

**Lincoln (Neb.) Telephone Earnings.**—The annual report of the Lincoln Telephone & Telegraph Company, which has been filed with the Nebraska State Railway Commission and covers the year ending June 30, 1910, shows that the company received from operation a total of $234,906 and expended $135,824. At the end of the year a surplus was shown of $3,820. During the year quite a considerable amount of extension of lines was made and paid for out of the earnings.

**Toronto Railway Company.**—The Board of Control of the city of Toronto has reported in favor of the purchase of the Toronto Railway Company, in order to convert it into a municipal system. The price mentioned for the possible purchase of the stock is $150 per share. In this connection it is said that the Toronto Railway Company is considering plans for constructing 16 miles of additional track, to be financed by a further issue of common stock.

**Shawinigan Water & Power Company.**—President J. E. Aldred, of the Shawinigan Water & Power Company, announces that an offer will be made to the shareholders of $500,000 new stock at par. The business of the company is rapidly growing and Mr. Aldred states that the dividend on the common stock will probably be increased in the near future to 5 per cent per annum.

**DIVIDENDS.**

American Pneumatic Service Company, semi-annual, preferred, 3½ per cent, payable Sept. 30.

Butte Electric & Power Company, quarterly, preferred, 1¼ per cent, payable Nov. 1; common, 1¾ per cent, payable Oct. 1.

Canadian Westinghouse Company, quarterly, 1¼ per cent, payable Oct. 1.

Columbus (Ohio) Light, Heat & Power Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Cumberland Telephone & Telegraph Company, quarterly, 2 per cent, payable Oct. 1.

Duluth Edison Electric Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Electrical Securities Corporation, preferred, semi-annual, 2½ per cent, payable Nov. 1; common, quarterly, 2 per cent, payable Sept. 30.

Germantown Passenger Railway Company, Philadelphia, quarterly, $1.31½ per share, payable Oct. 4.

Halifax Electric Tramway Company, quarterly, 1¾ per cent, payable Oct. 1.

Manila Electric Railroad & Light Company, quarterly, 1 per cent, payable Oct. 1.

Massachusetts Gas Companies, quarterly, $1 per share, payable Nov. 1.

Massachusetts Lighting Companies, quarterly, 1¾ per cent, payable Oct. 15.

Narragansett Electric Lighting Company, quarterly, $1 per share, payable Oct. 1.

Northwestern Elevated Railroad Company, Chicago, preferred, quarterly, 1 per cent, payable Oct. 18.

Otis Elevator Company, preferred, quarterly, 1½ per cent, payable Oct. 15.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

Toronto Electric Light Company, quarterly, 2 per cent, payable Oct. 1.

United Gas Improvement Company, Philadelphia, quarterly, 2 per cent, payable Oct. 15.

United Traction & Electric Company, Providence, R. I., quarterly, 1¼ per cent, payable Oct. 1.

West End Street Railway Company, Boston, semi-annual, 3½ per cent, payable Oct. 1.

Western Union Telegraph Company, quarterly, ¾ per cent, payable Oct. 15.

**REPORT OF EARNINGS.**

| | Gross earnings. | Expenses. | Net earnings. | Charges. | Surplus. |
|---|---|---|---|---|---|
| American Railways Company: | | | | | |
| Year ending June 30, 1910 | $693,678 | $340,385 | $353,293 | $342,072 | $11,221 |
| Year ending June 30, 1909 | 527,113 | 216,385 | 310,728 | 305,706 | 5,022 |
| Aurora, Elgin & Chicago Railroad Company: | | | | | |
| July, 1910 | 182,387 | 87,612 | 94,775 | 32,568 | 62,207 |
| July, 1909 | 167,614 | 77,894 | 89,720 | 28,895 | 60,822 |
| Edison Electric Illuminating Company of Boston: | | | | | |
| Year ending June 30, 1910 | 4,709,456 | 2,688,720 | 2,020,735 | 166,778 | 1,934,160 |
| Year ending June 30, 1909 | 4,111,342 | 2,766,029 | 1,345,313 | 88,846 | 1,303,827 |
| Fonda, Johnstown & Gloversville Railroad Company: | | | | | |
| Year ending June 30, 1910 | 904,751 | 421,522 | 470,824 | 353,650 | 117,174 |
| Year ending June 30, 1909 | 792,659 | 373,317 | 410,811 | 369,607 | 31,204 |
| Railways Company General: | | | | | |
| Year ending June 30, 1910 | 90,313 | 22,226 | 68,087 | ..... | 51,287 |
| Year ending June 30, 1909 | 91,467 | 25,070 | 76,397 | ..... | 76,397 |
| Western Union Telegraph Company: | | | | | |
| Quarter ending Sept. 30, 1910 (estimated) | ..... | ..... | 2,000,000 | 433,062 | 1,566,938 |
| Quarter ending Sept. 30, 1909 | ..... | ..... | 1,929,275 | 433,062 | 1,496,213 |

# General News

## Construction News.

ANNISTON, ALA.—It is reported that arrangements have been made with the Anniston Gas & Electric Company to supply electricity to operate the large gin plant in this city, recently purchased by a new company headed by J. H. Privett and D. C. Cooper.

MONTGOMERY, ALA.—The Montgomery Traction Company is contemplating the construction of a power plant to furnish electricity for operating its system. The company now purchases power from the Montgomery Light & Power Company. W. J. Ginnavan is general manager.

MONTGOMERY, ALA.—Bids will be received until Sept. 26 by the City of Montgomery for the installation of two 4-000-000-gal., electrically driven, direct-connected centrifugal pumps with motors and electrically driven, direct-connected air compressor with motor in the water-works pumping station. Gaston Gunter is Mayor.

TROY, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 24, for the construction, including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the U. S. post office at Troy, Ala., in accordance with drawings and specifications, copies of which may be secured from the custodian of site at Troy, Ala., or at the above office. James Knox Taylor is supervising architect.

JUNEAU, ALASKA.—Preparations are being made by the Alaska-Treadwell Company, of Juneau, to construct a large hydroelectric plant in the vicinity of its mines.

ATKINS, ARK.—W. F. Turner and J. W. Barker, of Atkins, Ark., have been granted a 50-year franchise by the Town Council to install an electric light plant in Atkins.

HAMBURG, ARK.—The Board of Commissioners of the Hamburg Improvement District has awarded the contract for the installation of an electric light plant and water-works system to W. J. Kennedy, of St. Louis, Mo. The cost of the work is estimated at about $30,000. Willis E. Ayres, 370 Randolph Building, Memphis, Tenn., is engineer.

HAZEN, ARK.—The Hazen Power Company is reported to be making preparations for the erection of an electric light and power plant. The equipment of the proposed plant will include a 250-hp engine, boilers with a rating of 300 hp and electric generators. A 10-ton ice plant will be operated in connection with system.

MAMMOTH SPRINGS, ARK.—It is reported that the Moore Manufacturing Company, which is now located at Springfield, Mo., is contemplating moving its machinery to Mammoth Springs, where it purposes to locate. It is understood that the plant will be equipped for electric motor drive. The company manufactures furniture.

BAKERSFIELD, CAL.—Negotiations have been closed whereby the plant and holdings of the Moran Electric Company are to be taken over by J. Q. Anderson and associates. It is proposed to extend and enlarge the system and furnish a twenty-four-hour service. The local distributing system will be rebuilt and will be tied in with the line from Maricopa. The new system will include three generating plants, two located at Maricopa and one in Bakersfield. Natural gas will be used for fuel.

BANNING, CAL.—Work is progressing on the White Water River project of the Consolidated Reservoir & Power Company. It is proposed to divert the water of the river to land owned by the company north of the town. Two or three power plants will be erected along the stream.

COALINGA, CAL.—Preparations are being made by the Coalinga Water & Electric Company to supply electricity for operating the pumps and other machinery in the Coalinga oil fields. The company has installed variable speed motors on the Goodluck property and is planning to demonstrate that not only pumping can be done by electricity, but that all of the mechanical work about the wells can be operated by electrical power. Demonstrating equipment will be placed on the J. T. O. property and on the National 30 lease of the Associated Oil Company. William Stranahan is manager.

FRESNO, CAL.—The first 5000-hp unit in the new Crane Valley power plant of the San Joaquin Light & Power Company, of Fresno, Cal., was put in operation Sept. 4. The second unit of 5000 hp will soon be started. Contracts have been placed with the General Electric Company for the remaining two units of 5000 hp and orders will soon be placed for the water wheels. These units will be of the same type as those already installed, and probably will be completed in the spring. Excellent progress is being made on the auxiliary plant in Bakersfield, Cal. J. G. White & Company, of New York, N. Y., have charge of construction of the plant.

MODESTO, CAL.—Plans are being considered by the Sierra & San Francisco Power Company, which took over the properties of the Stanislaus Electric Power Company and the Tuolumne Water Power Company, for the erection of a feeder line from its Stanislaus power line to this city. The proposed line will be at least 15 miles in length. It is expected that electricity will be supplied in Ripon and Salida and to farmers along the route for pumping and other purposes. It is understood that a new substation in the western part of the town will be completed by the first of the year. H. F. Jackson is general manager.

PASADENA, CAL.—The City Council has granted the request of C. W. Koiner, manager of the municipal electric light plant, for a loan of $15,000 from the general fund for improvements to the municipal electric light system. The installation of an additional boiler is contemplated.

PASADENA, CAL.—The directors of the Pasadena Rapid Transit Company will vote on Oct. 18 on the proposition to issue $3,000,000 in bonds, the proceeds to be used for the construction of an electric railway between Pasadena and Los Angeles. It is proposed to build a direct line without grade crossings. Horace M. Dobbins, of Pasadena, Cal., is president.

PLACERVILLE, CAL.—Preliminary steps have been taken which indicate the formation of a company to develop the water power from Rock Bound Lake and Buck Island above this city. The company owns water rights amounting to 25,000 cu. ft. from each and proposes to build dams to increase the capacity. Arthur Bloch, of Oakland, Cal., is interested in the enterprise. The Mercantile Trust Company, of San Francisco, Cal., holds the deed of trust and agrees to finance the proposition.

REDLANDS, CAL.—The City Trustees are considering plans for the erection of street lamps from Stuart Avenue on Orange Street to Olive Avenue on Cajon Street; also from Third to Sixth Streets on State Street and from Fourth to Fifth Street on Citrus Avenue. It is proposed to charge the cost of installing the system to the property owners. It is expected that concrete posts will be erected.

RICHMOND, CAL.—The Board of County Supervisors has granted the Richmond Light & Power Company a franchise to erect transmission lines along the public highways of the county.

STOCKTON, CAL.—Plans are being made by the Sierra & San Francisco Power Company, a subsidiary of the United Railways Investment Company of San Francisco and which owns the large power system which was built in Tuolumne County a few years ago by the Union Construction Company, financed by the Knickerbocker Trust Company, of New York, N. Y., to supply the southern section of San Joaquin County with electricity for all purposes. The company will install two transformers at either Manteca or Escalon to reduce the voltage from 100,000 to 15,000 volts for commercial purposes. A second transmission line is now being erected by the company from the headwaters in Tuolumne County to San Francisco.

VALLEJO, CAL.—Announcement has been made by the Vallejo & Northern Railways Company that it proposes to construct a branch line from Sacramento to Woodland. The company is building a railway to connect Vallejo, Cordelia, Suisun, Vacaville and Sacramento.

DENVER, COL.—The Denver Gas & Electric Light Company, which recently acquired the property and franchise of the Denver Steam Heating Company, is preparing plans for the installation of a steam heating system in Denver.

GOLDEN, COL.—It is reported that surveys are being made for the construction of an electric railway to connect the Golden smelter with the mines of Clear Creek and Gilpin counties. It is understood that the parties interested in the North American Smelter & Mines Company are interested in the project.

WASHINGTON, D. C.—Sealed bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 5, for furnishing and installing lighting fixtures in the U. S. buildings at Belvidere, Ill.; Elizabeth, N. J.; Elgin, Ill.; Manhattan, Kan.; North Adams, Mass.; Platteville, Wis.; Rawlins, Wyo.; Saratoga Springs, N. Y.; Albany, Ga., and Roanoke, Va., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Sept. 26, for furnishing the signal corps with one switchboard, common-battery, two-position, in accordance with specifications Nos. 544, 321-A, 430-A; drawings 688-D, 688-G.-L, 688J, 688K and 688L; also one distributing and protecting frame, sectional angle iron, mounting 300 pairs of central energy heat coils and lightning arrester protector equipment and 500 pairs of line terminals; protectors in groups of twenty, detachable from the frame and to be of the Western Electric Company's type 84-B or equal; no self-soldering heat coils will be considered. The line terminals shall also be mounted in groups of twenty on the opposite side of the frame from the arrester equipment. The frame shall be fully equippped as stated above and in addition the following extra material must be furnished: 100 heat coils, 50 pairs of carbons and 200 mica dielectrics. Captain J. S. Cowan is disbursing officer.

GAINESVILLE, FLA.—The committee appointed by the Board of Public Works to investigate the cost of installing an electric light plant in Gainesville has reported to the Board of Public Works that it would be necessary under present laws for the city to buy the holdings of the Gainesville Gas & Electric Company before it could operate a municipal plant. The city voted to issue bonds for the construction of an electric light plant more than a year ago. B. F. Hampton and Dr. M. H. DePass are members of the committee.

ATLANTA, GA.—The Board of Commissioners of Fulton County is considering the question of establishing an electric light and water plant and sewerage system on the county almshouse property, at a cost of from $17,000 to $20,000. Preliminary plans have been prepared by P. H. Norcross, engineer.

COVINGTON, GA.—The Board of Water and Light Commissioners is reported to be considering the question of increasing the output of the municipal electric plant. It is proposed to install a 125-kw generator and switchboard and to establish a day service.

CULDESAC, IDAHO.—The City Council has authorized an election to be held here in October to vote on the proposition to issue bonds for the installation of an electric light plant and water-works system.

NEZPERCE, IDAHO.—The Nezperce & Idaho Electric Railroad Company is reported to be contemplating the construction of an extension from Vollmer to Forest, a distance of fourteen miles.

WALLACE, IDAHO.—Preparations are being made by the Cœur d'Alene Iron Works to rebuild its plant which was recently damaged by fire. It is proposed to increase the capacity of the plant and equip it for electrical operation.

CHICAGO, ILL.—Sargent & Lundy, of Chicago, Ill., have been engaged by the Commonwealth Edison Company, of Chicago, Ill., to take charge of the mechanical work of its proposed new plant.

CHICAGO, ILL.—Contracts have been awarded by the Board of Trustees of the Sanitary District of Chicago as follows: For installing electrical equipment to W. H. Jackson, of Chicago, Ill., and for construction of tunnel and machine foundations to George H. Jackson, of Chicago, Ill.

CHICAGO, ILL.—It is reported that plans are being prepared by Bernard Barthel, engineer, 79 Dearborn Street, Chicago, Ill., for the installation of a steam heating and power plant in the Del Prado Hotel, located at Fifty-ninth Street and Madison Avenue. The equipment will include two 200-hp internally fired Scotch marine boilers, one 250-kw generator, a 12-ton refrigerating machine, feed water heater, pumps, electrical work and steam heating.

DECATUR, ILL.—The capital stock of the Decatur Southern Traction Company has been increased from $25,000 to $1,200,000. Plans have also been made to begin work at once on construction of the proposed railway from Decatur to Pana. H. C. Simmons, of Virden, Ill., is secretary.

GIBSON, ILL.—The Gibson Electric Light & Power Company is reported to have refused to renew its contract for street lighting with the city unless it is granted several concessions, among which is an extension of its franchise for twenty years, payment for lighting the public buildings and the right to charge private customers a minimum of $1 per month, which, it is said, the city will not grant. Unless the city can build a municipal plant the streets will not be lighted.

KANE, ILL.—Plans are being considered for the installation of an electric light system in Kane. A proposition has been submitted to the town officials by F. M. Sinsabaugh, manager of the Carrollton Heat, Light & Power Company, to supply energy to operate the plant.

KANKAKEE, ILL.—The capital stock of the Kankakee Gas & Electric Company is reported to have been increased from $5,000 to $850,000.

MOUNT STERLING, ILL.—The People's Electric Light, Power & Telephone Company has applied to the City Council for a franchise to construct an electric light plant and telephone system in Mount Sterling. The company proposes to furnish a twenty-four-hour service and will pay the city 2 per cent of its gross earnings and give free telephone service to city officials and also gives the city the right to purchase the plant at cost any time within ten years. If granted a franchise the proposed plant will be in operation within forty days. C. B. Dearborn and George D. Givens are interested in the project.

QUINCY, ILL.—A committee has been appointed by the Civic Improvement League for the purpose of preparing plans to install an ornamental lighting system in the business district of the city. A. E. Kidd, president of the league, is a member of the committee.

ROCK ISLAND, ILL.—The Galesburg & Rock Island Traction Company is reported to have awarded a contract to the London Construction Company for the construction of its proposed electric railway to connect Galesburg and Rock Island, forty-one miles in length. Warren C. McWhinney is president.

BATESVILLE, IND.—The Batesville Electric Light & Power Company, recently incorporated, it is reported, will soon ask for bids for the construction and equipment of an electric power plant. J. A. Hillenbrand is president.

GREEN CASTLE, IND.—The City Council has decided to install incandescent lamps in the principal alleys in this city.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company and the Merchants Heat & Light Company are extending their lines to all towns and cities within a radius of twenty miles from this city. The territory has been divided by the company and both are securing franchises and contracts from farmers and residents in the towns and villages at a maximum rate of 10 cents per kw-hour for domestic purposes in some districts and in others 7½ cents per kw-hour.

MICHIGAN CITY, IND.—A large dairy farm of 2000 acres is being established by C. W. Hotchkiss and John Fields west of this city. The farm will be equipped with the latest appliances, including a complete set of electric milkers.

MICHIGAN CITY, IND.—The South Shore Traction Company has completed extensive improvements to its plant and is now in a position to supply 60-cycle alternating current along its lines from South Bend to Kensington. The company is erecting a line from Chesterton to Porter, where it has contracts to supply electrical power for operating factories. This line will be completed within thirty days. The construction of a transmission line from Michigan City to Chesterton is also under consideration.

MUNCIE, IND.—The Muncie Electric Company is erecting a transmission line from its power house in Muncie to Dunkirk and Redkey.

NOBLESVILLE, IND.—The Circuit Court of Hamilton County has authorized Ralph H. Beaton, of Columbus, receiver of the White River Light & Power Company, of Noblesville, Ind., to issue $100,000 in receiver's certificates to complete the dam in connection with the company's proposed hydroelectric power plant.

SOUTHPORT, IND.—Applications have been filed with the Town Board of Southport by the Merchants Heat & Light Company and the Indianapolis Light & Heat Company, both of Indianapolis, Ind., for a franchise to furnish electricity in Southport for lamps and motors. The Indianapolis company is extending its transmission lines to the Bertermann Brothers' flower farm, seven miles distant, and is contemplating extending its lines to Cumberland with a view of lighting that village and the farmhouses along the route. The Town Board is considering the propositions submitted by both companies.

BRITT, IA.—The Western Electric Telephone Company has acquired the controlling interest in the Hancock County Telephone Company, which maintains exchanges in Garner, Britt and Kanawha.

CEDAR RAPIDS, IA.—Preparations are being made by the Cedar Rapids & Marion Telephone Company for improvements to its system in Cedar Rapids, which will involve an expenditure of about $22,000.

DAVENPORT, IA.—The Union Electric Telephone & Telegraph Company has applied for an amendment to its franchise ordinance to permit it to sell its system to the Iowa Telephone Company.

ELDORA, IA.—At an election held Sept. 12 the citizens voted in favor of the proposition allowing the Park Dam Company to construct a dam across the Iowa River at this place. The company proposes to install an electric power plant at a cost of about $25,000 and furnish a twenty-four-hour service. A. H. Latimer, of Eldora, Ia., is engineer in charge and George W. Wood is secretary.

FORT DODGE, IA.—The Corn Belt Packing Company is reported to be contemplating the construction of a new plant, which will be equipped for electrical operation.

FORT DODGE, IA.—The Fort Dodge, Des Moines & Southern Railroad Company is contemplating the erection of a substation this fall, which will be equipped with transformers and two rotary converters with a rating of 400 kw each. It is understood that Westinghouse machinery will be specified.

PELLA, IA.—Contracts have been awarded for the construction of a combined water and light plant in Pella as follows: To the Des Moines Bridge & Iron Company, of Des Moines, Ia., for laying 18,500 ft. 10-in. pipe, $9,269; furnishing valves, hydrants and specials, $1,150; constructing filter gallery, well and pump house, $6,600; to Joseph E. Bortenlanger, of Omaha, Neb., for furnishing engines, boilers, generators, motors and all electrical apparatus, $21,652; two triplex pumps, $3,590; 3½ miles of transmission line, $3,750; for city distributing system, complete, $10,152, and secondary wiring, $3,500; for constructing power house, to K. A. Verhey, for $6,390. Murray Corliss engine, Ideal high-speed engine, Murray boilers and Westinghouse generators and motors will be used. The Iowa Engneering Company, of Clinton, Ia., has charge of the engineering work. A. C. Kuyper is city clerk.

PERRY, IA.—The Commercial Club is interested in a project to install an ornamental street lighting system in the business portion of the city. The cost of maintaining the system is estimated at $160 per month.

SANBORN, IA.—The citizens have voted to grant W. D. Bowen, of Charles City, a franchise to install an electric light plant in Sanborn.

BELLEVILLE, KAN.—It is reported that the plant of the Belleville Light & Power Company, which was recently destroyed by fire, will be rebuilt.

HERINGTON, KAN.—Negotiations have been closed whereby the City of Herington will supply electricity in the City of Hope for street lighting and for commercial purposes for a term of ten years. A transmission line, eight miles in length, will be erected from the municipal electric plant in Herington to Hope. Current will be transmitted for the present at 2300 volts, three-phase over No. 6 bare copper wire. Bids for materials for the line and for the system in Hope, including transformers, switchboard and instruments, will be asked for in the near future. H. L. Stromquist is superintendent of the Herington water and light department.

HUTCHINSON, KAN.—Preparations are being made by the Missouri & Kansas Telephone Company for extensive improvements to its system, which will involve an expenditure of about $200,000.

TOPEKA, KAN.—Extensive improvements are being made to the plant of the Topeka Edison Company, which includes the installation of two 500-hp boilers and 16,000 ft. of cable in the business district of the city.

WICHITA, KAN.—A transmission line is being erected by the Kansas City Gas & Electric Company from its plant in this city to Valley Center, Kan., for the purpose of supplying electricity to operate the proposed electric railway of the Arkansas Valley Interurban Railway Company. The power house now being erected at the junction of the Big and Arkansas rivers by the Kansas Gas & Electric Company is expected to be completed by Nov. 1. The cost of the transmission line and equipment is estimated at about $50,000.

LIBERTY, KY.—The construction of an electric railway to connect Liberty and Moreland is under consideration by Liberty and Moreland business men.

LOUISVILLE, KY.—The Turner, Day & Woolworth Company, of Louisville, Ky., has recently equipped its plant for electric motor drive.

MAYSVILLE, KY.—The City Council is reported to have passed an ordinance authorizing a special election to vote on the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

AUBURN, MAINE.—The City Council has awarded the Lewiston & Auburn Electric Light Company the contract for lighting the streets of the city for a period of five years, at $55 per lamp per year, the same price as paid under the present contract.

BONNY EAGLE, MAINE.—The contract for construction of a 60-ft. dam and power house for an 8000-hp hydroelectric development on the Saco River, at Bonny Eagle, Maine, has been awarded to the F. W. Abbott Company, 90 West Street, N. Y., by the Cumberland Construction Company. J. Y. White & Company have charge of construction of the plant.

SKOWHEGAN, MAINE.—Bids will be received until Sept. 29 by the Skowhegan Water Power Company for the construction of a concrete dam across the north channel of the Kennebec River, at Skowhegan. Plans and specifications may be seen at the office of C. S. Humphreys, hydraulic engineer, Madison, Maine, or at the office of F. A. Nolan, secretary of the Skowhegan Water Power Company, Skowhegan, Maine.

BOSTON, MASS.—The report that the Hoosac Tunnel would be equipped for electrical operation is reported to have been confirmed by the officials of the Boston & Maine Railroad Company. The cost of the work, including electric locomotives, is estimated at about $1,000,000. When the changes are completed, both passenger and freight trains will be taken through Hoosac Mountain from Tunnel Station on the east to North Adams, and possibly to Williamstown, on the west side.

BOSTON, MASS.—Superintendent of Streets Louis K. Rourke has withdrawn his call for bids for a two-year contract for lighting the streets and has decided to ask for bids for a five or ten-year contract for lighting the streets, parks and alleys by either gas or electricity. The contract affected is the one now held by the Rising Sun Street Lighting Company, which supplies 12,000 gas lamps. The contract expires Feb. 1, 1911. The company supplies 60-cp gas lamps at $23.60 each per year, which is $1.29 per lamp more than the city pays for electric lamps of the same illuminating power. Consent of the Mayor and City Council will have to be secured before a contract for more than two years can be awarded.

FALL RIVER, MASS.—Contracts have been awarded for power plant equipment for the Charlton Mills as follows: To the Providence Engineering Works, Providence, R. I., for one 10,000-hp Rice & Sargent, cross-compound steam engine, and to the Westinghouse Electric & Manufacturing Company, for an 850-hp, low-pressure steam turbine to generate electricity to operate the weaving mill, elevators and some of the spinning machines. The turbine will be operated by exhaust steam from the main engine.

LUDLOW, MASS.—The Ludlow Manufacturing Association has recently installed a 300-kw alternating-current generator in its plant to supply electricity for lamps and motors in mill No. 5. The company has also placed an order for a 2500-kw turbo-generator set to be installed, which will be used as an auxiliary in case of a breakdown or low water.

WALTHAM, MASS.—The Edison Electric Illuminating Company recently submitted a proposition to the Waltham Board of Trade offering to erect and maintain three large electric signs in this city, advertising Waltham as a desirable place for manufacturers to locate in, if the Board of Trade would provide the locations for the signs.

WORCESTER, MASS.—The Worcester Electric Company has applied to the Massachusetts Gas & Electric Light Commission for permission to issue 2000 additional shares of capital stock at $100 par value, the price being fixed by the directors of the company at $180 per share. The proceeds to be used in connection with the construction of a new steam turbine plant at Curtis Pond, in the southern section of the city. The cost of the new plant is estimated at about $500,000.

WORCESTER, MASS.—Plans have been completed for enlarging the Millbury plant of the Worcester Consolidated Street Railway Company to supply electricity for operating the entire system. The plans also call for the erection of a substation in Worcester, at Beacon and Madison streets. Power from the Millbury plant will be transmitted to Worcester over lines carrying three-phase current at 13,000 volts, which will be erected on private right of way. Orders have been placed for equipment of power plant at Millbury and substation in Worcester, which, it is said, will call for an expenditure of about $500,000 and will include a General Electric 5500-kw, 13,000-volt, 3-phase, 25-cycle turbo-generator set; two rotary converters, switchboards, transformers, etc.; also four water tube boilers with a total rating of 11,360 hp. The power station of the company at Fremont Street will be used as an auxiliary station when the Millbury plant is completed.

CENTREVILLE, MICH.—Plans are being prepared by Vance I. Gray, 226 Huron Street, Toledo, Ohio, for a new electric light plant and waterworks system for the Centreville Water & Light Company. F. W. Thomas, 1919 Monroe Street, Toledo, Ohio, is secretary of the company.

DETROIT, MICH.—Smith, Hinchman & Grylls, of Detroit, Mich., are reported to be preparing plans for an addition to the municipal power plant.

GRAND RAPIDS, MICH.—It is reported that the Crawford Chair Company, of Grand Ledge, Mich., is contemplating the erection of a factory in Detroit, Mich. The plant, it is said, will be equipped for electrical operation.

KALAMAZOO, MICH.—C. K. Goff, of Battle Creek, Mich., owner of the so-called Armstrong franchise, has submitted a proposition to the City Council proposing that the Council return the $5,000 deposited with the city treasurer or extend the time for completing the work on the proposed electric light, heat and power plant until Jan. 1, 1911. Under the terms of the franchise the money was to revert to the city in case work to the amount of $10,000 was not completed on the system by Sept. 1, 1910. The money was advanced by Mr. Goff to Frank W. Armstrong to secure the extension to the franchise. Owing to the failure to promote the project to build the power plant, the franchise was transferred to Mr. Goff in June. The franchise has twenty-eight years to run. Mr. Goff is willing to turn it over to the city for the return of the forfeit money.

LANSING, MICH.—The new system of tungsten streets lamps, recently installed, is giving satisfaction, and the business men are anxious to have the lamps installed on the side streets, which will probably be done next year. About $20,000 has been expended on the street lighting system this year.

OXFORD, MICH.—It is understood that the City of Oxford, Mich., is contemplating the installation of a motor-driven centrifugal pump of about 500,000 gal. per day capacity in the municipal electric light and water plant in the near future.

AURORA, MINN.—The City Council is reported to have awarded the contract for lamp standards to be used in connection with the installation of an ornamental street lighting system to the Thompson & Stewart Company, of Duluth, Minn.

BUFFALO, MINN.—The Village of Buffalo is planning to install a 100-hp electric plant. The equipment will include a producer-gas outfit.

DULUTH, MINN.—The Great Northern Power Company is reported to have commenced condemnation proceedings for a site at Beaver Creek for a large storage reservoir.

EVELETH, MINN.—The Commercial Club is reported to have petitioned the Council for an appropriation of $6,000 to install an ornamental illuminating system on Grant Avenue.

FAIRMONT, MINN.—At an election held recently the citizens voted in favor of the proposition to issue $30,000 for improvements and extensions to the municipal electric light plant.

ROCHESTER, MINN.—The Board of Public Utilities has petitioned the City Council for an appropriation of $5,000 to be used for improvements to the municipal electric light plant.

STARBUCK, MINN.—Arrangements are being made by the White Bear Lake Telephone Company for the erection of about fifteen miles of rural lines this fall. A. H. Dreyer is manager.

STARBUCK, MINN.—We are informed that the Village of Starbuck would like to receive prices on a 50-hp or 55-hp Corliss engine and boiler, complete, for the municipal light and water plant. A. H. Dreyer is superintendent.

ST. LOUIS, MO.—It is reported that a meeting of the stockholders of the Suburban Light & Power Company will be held Sept. 22 to vote on the proposition to increase the capital stock of the company from $200,000 to $750,000.

ST. LOUIS, MO.—It is reported that prices are being received by the general purchasing agent of the Missouri Pacific Railway Company, St. Louis, Mo., on a large list of tools, a large part of which will be motor-driven. The list calls for boring machines, planers, radial drills, lathes, slotting machines, grinders, bolt cutters, pipe machines, punchers, boring and turning mills, etc., two 15-hp, 725-r.p.m., 220-volt, constant-speed, direct-current, shunt-wound electric motors, complete with low voltage release starting rheostat; one 5-hp, 975-r.p.m., 220-volt, constant-speed, shunt-wound electric motor, complete with low voltage release starting rheostat; one 30-hp, 1025-r.p.m., 220-volt, direct-current, constant-speed, shunt-wound electric motor, complete with release starting rheostat; one 7½-hp, 975-r.p.m., 220-volt, direct-current, constant-speed, shunt-wound electric motor, complete with minimum speed release starting rheostat; two 15-hp, 220-volt, 25-cycle, 719-r.p.m., three-phase induction motors, complete with sliding bed plate, pulley and auto starter; one 30-hp, 220-volt, 25-cycle, three-phase, 1430-r.p.m. induction motor, com-

plete with sliding base, pulley and auto starter; one 7½-hp, 220-volt, 25-cycle, three-phase, 705-r.p.m. induction motor, complete with sliding base, pulley and auto starter; one 50-hp, 220-volt, direct-current, constant-speed, shunt-wound, with low voltage release starting box.

VICTOR, MONT.—Announcement has been made that the Missoula Light & Water Company has purchased the electric plant at Victor, owned by J. S. Hodges, and proposes to make it part of the extensive system which is being developed between Missoula and Hamilton. The purchase of this plant gives the Missoula Light & Water Company control of all the light and power franchises throughout the valley. The principal branch office will be located in Hamilton.

BLADEN, NEB.—It is reported that the citizens have voted to issue bonds for the installation of a lighting system.

WALLHILL, NEB.—Bonds to the amount of $22,500 are reported to have been sold by the Village of Wallhill, the proceeds of which will be used for the construction of an electric light plant and water-works system.

MADISON, N. J.—A report has been submitted to the Council by the lighting committee recommending an expenditure of from $5,000 to $10,000 for improvements and new equipment to the municipal electric light plant. The Council has decided to establish a meter service throughout the borough, beginning April 1, 1911.

WOODBURY, N. J.—Sealed proposals will be received by the City Council until Sept. 27 for the construction of about 7700 ft. of 8-in. vitrified pipe sewers, with manholes and flush tanks and a pumping station equipped with duplicate rotary pumps and electric motors, automatically controlled, and about 1100 ft. of 6-in. cast iron force main, in accordance with plans and specifications on file at the office of the city clerk, Woodbury, N. J., and at the office of the City Wastes Disposal Company, 156 Fifth Avenue, New York, N. Y. Plans and specifications may be obtained from the city clerk, for which a deposit of $5 will be required to insure return of same. Arthur Starr is city clerk.

ALBUQUERQUE, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 4, for an electric elevator in the U. S. post office building at Albuquerque, N. M., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

ALBANY, N. Y.—The Municipal Gas Company, of Albany, N. Y., has been authorized by the Public Service Commission, Second District, to exercise franchises granted by the Town of Bethlehem to furnish electricity along the Albany and Greene Turnpike and all the public roads and highways intersecting the Albany and Greene Turnpike in the Town of Bethlehem.

BUFFALO, N. Y.—The contract for installing a power plant at the Erie County Penitentiary has been awarded to Timothy McEvoy & Sons, for $53,948.

LONG BEACH, N. Y.—The Long Beach Power Company has filed a $500,000 mortgage in the office of the county clerk in favor of the Lincoln Trust Company to secure funds for improvements to its property in Long Beach.

NEW YORK, N. Y.—A proposition has been submitted by William G. McAdoo, president of the Hudson & Manhattan Railroad Company, to the Public Service Commission, First District, for the construction and operation of a subway railway connecting the Thirty-third Street station of his system with the Hudson Terminal station at Cortlandt Street. It is proposed that the line be constructed on the city's credit and leased upon terms similar to those of the present subway.

RED HOOK, N. Y.—The Red Hook Light & Power Company has been granted permission by the Public Service Commission, Second District, to take over the franchises held by John H. Sharpe in the towns of Germantown, Livingston and Clermont, in Clermont County, and to exercise privileges granted under the franchise. The company is also authorized to execute a mortgage upon its property to secure an issue of $150,000 in bonds. At the present time the company is authorized to issue $10,000 of the bonds at not less than par in exchange for $10,000 bonds now outstanding on the property; also $60,000 in bonds to be sold at not less than $80 to settle indebtedness incurred in construction of new lines and equipment.

RENSSELAER, N. Y.—The committee of the Common Council is negotiating with the Albany Southern Railroad Company for substituting the present street lighting system with tungsten lamps of 32 cp. The company has submitted a proposition to the committee offering to replace the 25-cp incandescent lamps with tungsten lamps of 32 cp, or to furnish 40-cp tungsten lamps at an additional cost of $1.75 per lamp per year, providing the city would enter into a contract with the company for a term of five years, which the city is not willing to do.

SODUS, N. Y.—Announcement has been made that the Sodus Gas & Electric Company has decided to extend its transmission lines from Williamson to Pultneyville, a distance of about four miles. The owners of the large flour mill have agreed to utilize electricity to operate the mill and the residents of the Village of Pultneyville have petitioned for street lamps. The property owners between Williamson and Pultneyville have also contracted for street lamps. Work on the extension will begin in the near future.

TONAWANDA, N. Y.—The Frontier Electric Railroad Company, which proposes to construct an electric railway from Buffalo to Niagara Falls, has reached an agreement with the city officials of Tonawanda and North Tonawanda by which the company will be granted a franchise in those cities. The company has acquired all the right of way of the Buffalo, Thousand Islands & Portland Railroad, between Buffalo and Niagara Falls. James Simmons is interested in the project.

WALTON, N. Y.—The Public Service Commission, Second District, has authorized the Southern New York Power Company to issue $24,000 in capital stock at par in payment of all the property, franchises and holdings of the Walton Electric Light Company, of Walton, N. Y., and $2,100 in payment of property and franchises of the Mulkins electric light plant, located in Walton. The company applied to the commission for permission to issue $40,000 to purchase the plant and holdings of the Walton Electric Light Company.

CHARLOTTE, N. C.—The Southern Power Company is reported to have awarded a contract for the installation of a 4000-hp plant for the production of nitrate by an electrochemical process. The first plant, which will be used largely for experimental purposes, will be located near the Great Falls power plant of the company in South Carolina. The company is said to be contemplating the installation of a 24,000-hp plant, the site for which has not yet been decided upon.

EDONTON, N. C.—The Board of Public Works will receive proposals for one 75-kw, alternating-current, single-phase, 60-cycle generator, direct connected to a simple automatic engine. For further information adress J. C. Martin, superintendent of the municipal electric light and water department.

GREENSBORO, N. C.—The Board of Aldermen and the Water and Light Commission are considering the question of establishing a municipal electric light plant in Greensboro.

SALISBURY, N. C.—Contracts have been placed by the Hambley Manufacturing Company for 50 broad looms and auxiliary machinery for the production of mercerized damask. The plant will be operated by electricity. C. C. Adams is president of the company.

CLEVELAND, OHIO.—The Lake Shore Railroad Company is reported to have placed orders for generators for its Elkhart shops, and, it is said, will purchase in the near future motors with a total rating of 5000 hp.

CLEVELAND, OHIO.—The Electric Controller & Manufacturing Company is reported to have engaged George S. Rider & Company, engineers, to prepare plans for the construction of its new plant, for which the company recently purchased a site at Eightieth Street and Bessemer Avenue, in Cleveland.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company is reported to have contracted with the General Electric Company, of Schenectady, N. Y., for two 1500-kw steam turbines, to be installed in its plant at the foot of Seventieth Street. It is understood that other equipment, including exciters, will be purchased later.

CLEVELAND, OHIO.—The Commissioners of Cuyahoga County have entered into a contract with the Cleveland Electric Illuminating Company to furnish electricity and heat for the new court house, now under construction. The contract is for a period of ten years, without a terminating clause, and under its terms all the equipment under the county ground becomes the property of the county at the expiration of the contract. The company agrees to supply electricity at the rate of 3.33 cents per kw-hour and 27 cents a unit for steam. It is estimated that the county will save $150,000 in the ten years, above the expense of establishing and maintaining a plant of its own.

COLDWATER, OHIO.—The New Idea Spreader Company is reported to have awarded contracts for the erection of a new plant, 60 ft. x 100 ft., as follows: For construction of power house, to A. De Curtins, of Lima, Ohio; Anton Burchard, engineer, of Cleveland, Ohio, for electrical installation, and Ammerman, McCall & Anderson, of Detroit, Mich., for heating and ventilating. A 200-hp power plant will be installed.

COLLEGE CORNER, OHIO.—A franchise has been granted to Robert S. Ashe, of Richmond, Ind., to install an electric light system in College Corner. Electricity for operating the system will be transmitted from Richmond.

COLUMBUS, OHIO.—The committee appointed by the City Council to make investigations regarding the cost of equipping the municipal electric light plant to furnish electricity for lamps and motors for commercial purposes has decided to recommend the City Council to submit to a vote at the November election the proposition to issue $150,000 in bonds to pay for same. If bonds are authorized it is proposed to expend $75,000 next year for equipment to equalize the power so that a day and night load can be carried. The remainder will be held for new generators when needed. It is estimated that with an expenditure of $75,000 the income from day contracts would be sufficient to pay the operating expenses of the plant. The City Council is considering the question of providing for a bond issue of $200,000 instead of $150,000, the proceeds of $50,000 to be used to extend the lighting system to the recently acquired territory.

NILES, OHIO.—Plans are being prepared by the Mahoning & Shenango Valley Railway & Light Company for improvements to its system in Niles, which will involve an expenditure of about $100,000. A new substation, car barn and freight station will be built.

HENRYETTA, OKLA.—At an election held recently the citizens voted to grant an electric light franchise to B. T. Lilly and associates.

SHAWNEE, OKLA.—It is reported that the Chicago, Rock Island &

Pacific Railway Company is contemplating the installation of an electric plant to supply electricity for lamps and motors for its Shawnee shops. J. B. Berry, Chicago, Ill., is chief engineer.

WOODWARD, OKLA.—The Woodward Cotton Company has applied to the Federal Court for a writ to restrain the municipality from erecting and operating an electric light plant. The company claims that it has an exclusive franchise for twenty years and that a municipal plant will put the company out of business. The city on Aug. 20 voted to issue $20,000 in bonds to construct a new plant.

DUFUR, ORE.—We are informed that an electric lighting system will be installed in Dufur. W. Brigham, of Dufur, Ore., is engineer.

PORTLAND, ORE.—The directors of the Pacific Power & Light Company are reported to have decided to erect about 200 miles of transmission lines at once in Eastern Oregon and Washington, which will involve an expenditure of from $500,000 to $600,000.

PORTLAND, ORE.—The Pacific Power & Light Company is reported to be considering the purchase of several large tracts of land in the Middle Columbia River basin in connection with its purpose of making a specialty of furnishing electricity for operating irrigation pumps.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 14, for condenser, motor-driven engine lathe, valve reseating machine, rivet sets, machine bits, cold-shuts for steam shovels, manganese steel plates, etc. Blanks and general information relating to this circular (No. 606) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

AVONDALE, PA.—The plant and holdings of the Chester County Electric Company have been sold, under an order of the Court of Chancery, to the Central Trust & Savings Company, of Philadelphia, Pa., for $10,000. The property includes a mill and water rights and electric plant in New Castle County, which supplies electricity in several towns in Chester County. The trust company held a mortgage on the plant.

LEECHBURG, PA.—The Pittsburgh & Allegheny Valley Railway Company is reported to have purchased a site in North Vandergrift, on which it will erect a power station.

SHICKSHINNY, PA.—Plans are being considered for increasing the output of the municipal electric light plant, which will probably be submitted to the voters at the next election. The installation of an engine and generator, a mercury rectifier and transformer for arc lamps is contemplated. William T. Davis is superintendent.

SUNBURY, PA.—The Edison Electric Illuminating Company has ordered from the General Electric Company, of Schenectady, N. Y., a complete luminous arc outfit for street lighting purposes. R. V. West, manager.

REDFIELD, S. D.—Bids will be received by the City Council until Oct. 3, for a 150-hp boiler for the municipal electric light plant. H. T. Patch is city auditor.

BRYAN, TEX.—Plans are being considered by the Bryan-College Interurban Company to extend its railway into the Brazos River bottoms, connecting several small towns. Preparations are now being made by the company to extend its system over the streets of Bryan and to run a loop around the outskirts of the town. O. E. Gammill is manager of the company.

CENTER, TEX.—The capital stock of the Center Light & Ice Company is reported to have been increased to $20,000 and the output of the ice plant increased to 20 tons. The company proposes to install additional machinery to supply electricity to operate fans and motors on its system.

GEORGETOWN, TEX.—The City Council is considering a proposition to issue $50,000 in bonds, the proceeds to be used for the purchase of the water and electric plant of the Georgetown Water, Light & Power Company, to be operated by the municipality. If the plant is taken over by the city, improvements will be made to it.

PALESTINE, TEX.—The City Commissioners have granted George W. Burkett and associates a franchise to build a street railway in Palestine.

ROSEBUD, TEX.—Negotiations have been closed whereby I. J. Nathan, owner of the electric light and ice plant at Marlin, has purchased the electric plant at Rosebud. It is understood that the new owner will make improvements to the system and install an ice plant.

WELLSVILLE, UTAH.—Application has been filed with the state engineer by H. C. Baker and H. J. Craven, of Ogden, Utah, for 10 cu. ft. per second of the water of Spring Branch, near Wellsville, Cache County. The water is to be utilized to operate an electric plant in Cache County and will be diverted by means of a channel 10,500 ft. in length. The plant will be operated under a head of 500 ft. and will develop about 455 hp.

COVINGTON, VA.—E. M. Nettleton is contemplating the installation of an electric generator at his planing mill for supplying energy for lighting the mill and electric service at his residence.

FALLS CHURCH, VA.—The stockholders of the Washington-Virginia Railway Company have voted to increase the capital stock of the company from $1,000,000 to $3,000,000. The company proposes to construct and operate an electric railway from Bluemont to Vienna, a distance of about fifty miles. M. E. Church, of Church Falls, is president.

BELLINGHAM, WASH.—Application has been made to the City Council by J. D. Crary, representing the Gray's Harbor Electric Company, of Aberdeen, Wash., for a franchise to build an electric railway in Bellingham. The company has also applied for franchises in South Bend and Raymond, Wash.

FREEWATER, WASH.—The City Council has granted the Walla Walla Valley Traction Company a franchise to construct and operate an electric railway in Freewater.

IRONDALE, WASH.—The Western Steel Corporation has entered into a contract with the Olympic Power & Development Company whereby the power company will furnish 2500 hp, within eighteen months, for use in connection with its steel plant in Irondale, with an option of 2500 hp additional after the 2500 hp shall have been delivered. The Olympic Power & Development Company is now constructing a power plant on the Elwah River, six miles from Port Angeles, at a cost of about $500,000.

MARCUS, WASH.—It is reported that arrangements are being made by the Kettle River Power & Light Company for the construction of its proposed power plant, work on which will begin in the near future. The cost of the plant is estimated at $191,000. The company will supply electricity for the mine and for lamps and motors in Marcus. H. Allenburg, of Spokane, Wash., F. L. Tate and other capitalists, of Philadelphia, Pa., are interested in the project.

SEATTLE, WASH.—The control of the water power of the Priest Rapids, in the Columbia River, in Grant and Yakima Counties, Washington, has been purchased by the American Power & Light Company, of New York, N. Y., from the Hanford Irrigation & Power Company. The property of the Hanford company is estimated to be worth $4,000,000.

SEATTLE, WASH.—It is reported that negotiations are under way for the consolidation of the Hanford and Strathorn irrigation canals and power plants on Priest Rapids. The project, it is said, will involve an expenditure of about $90,000,000 in Northwestern power development. S. Z. Mitchell, of New York, N. Y., president of the Electric Bond & Share Company and chairman of the board of supervisors of the Pacific Light & Power Company, has charge of financing the project.

SEATTLE, WASH.—Plans are being made by the International Lead & Iron Company to develop its lead and hematite iron ore properties in British Columbia. The company proposes to establish furnaces and build a pipe foundry and car-wheel plant. Power for operating the proposed works will be secured from a hydroelectric plant which is now being installed near the company's holdings. The local office of the company is located in the Columbia Block. H. H. Shallenberger, of Spokane, Wash., is secretary of the company.

WILSON CREEK, WASH.—Work has commenced on the construction of the power house for the proposed electric light and power plant in Wilson Creek. The plant is being erected by C. J. Weller, who was recently granted a franchise by the City Council. It is expected to have the plant in operation by the middle of November.

MORGANTOWN, W. VA.—The South Morgantown Traction Company is contemplating extending its railway in Morgantown, and franchise will soon be applied for. It is proposed to extend the railway from Morgantown to Fairmont.

SHEPHERDSTOWN, W. VA.—The Town of Shepherdstown is reported to be considering the question of installing a municipal power and pumping station.

THOMAS, W. VA.—The Davis Coal & Coke Company is constructing a central power plant to generate electricity for all mines located in this district. The boiler plant will be equipped with water-tube boilers and underfeed stokers; waste fuel will be used for the boilers. The electrical apparatus will include three turbo-generator sets with a rating of 2500 kw. Substations will be erected at each mine and both direct and alternating-current supplied at all stations. The main transmission lines will form two complete circuits, 11 miles in length. It is understood that contracts have been placed for machinery. B. F. Bush, 702 Continental Building, Baltimore, Md., is president.

MILWAUKEE, WIS.—The State Railroad Commission has issued a certificate of necessity to the Milwaukee Western Electric Railway Company for the construction of an electric railway from Beaver Dam to Fox Lake.

NORTH MILWAUKEE, WIS.—The North Milwaukee Light & Power Company has been authorized by the Railroad Commission to issue 500 shares of common stock at par value of $500 each, the proceeds to be used to pay outstanding indebtedness incurred by additions to the property and to provide for future extensions.

REEDSVILLE, WIS.—The Wisconsin Pea Canners Company is reported to be contemplating the construction of a new factory at Reedsville, for which power and operating machinery will be required.

SHEBOYGAN, WIS.—The Sheboygan Railway & Electric Company has been granted permission by the Railroad Commission to issue $600,000 in bonds, of which the proceeds of $440,000 will be used for retiring or refunding an outstanding issue to the amount of $400,000 and $160,000 for paying outstanding floating indebtedness. The balance is to be used for the erection of new car barns and the purchase of additional rolling stock, machinery, etc.

SUPERIOR, WIS.—One of the docks which have been leased by the

Great Northern Railway Company to the Philadelphia & Reading Coal Company is to be remodeled and new electrically operated equipment for handling freight installed.

SUPERIOR, WIS.—Preparations are being made by the Superior Water, Light & Power Company for improvements in its three departments during the next year which will involve an expenditure of about $150,000. Half of this amount will be expended on the water plant this year. The plans call for a larger pipe line and one or two new pumps. Allen Hazen, 103 Park Avenue, New York, N. Y., is consulting engineer. W. H. Winslow is manager.

LORAINE, WYO.—The Southern Wyoming Telephone Company, recently incorporated, is planning to erect a telephone line from Loraine to Bosler, thence to Medicine Hat, where it will connect with 100 miles of wire having no outlet. The company is capitalized at $25,000. The company has taken over the telephone line to the Rambler mine. R. D. Stewart is secretary and treasurer.

SHERIDAN, WYO.—The Sheridan Electric Light & Power Company has commenced work on the erection of a new transmission line from its local plant to the Acme and Monarch mines, where the company has contracts to supply 600 hp. The contracts provide for day service only, until the new 4000-hp plant on the Big Goose and Toungue River is completed, which, it is expected, will be ready for operation this fall.

MEDICINE HAT, ALTA., CAN.—The Alberta Southeastern Telephone Company, operating telephone lines from Medicine Hat to Cypress Hills in the Province of Alberta, has received an offer from the Provincial Government for the purchase of its system. It will probably be accepted.

NELSON, B. C., CAN.—The Pacific Exploration Company is reported to have been granted permission to erect an electric power plant on Pend d'Oreille River, near Waneta. The company proposes to install a 25,000-hp plant and furnish electricity to the Pend d'Oreille Valley, the Sheep Creek and Ymir districts, and to the Orient, Cheweha and Metaline districts. H. C. Hall, of Nelson, B. C., Can., is president.

VICTORIA, B. C., CAN.—It is reported that the Portland Canal, Light, Water & Power Company, which is now supplying the Stewart with electricity, has abandoned the proposed power house site on the Marmot River and will build on the American Creek, where, it is stated, some more power can be developed. Arrangements have been made with the Stewart Land Company for the change of power sites. The company proposes to install a large power plant and distribute electricity throughout the entire district. At present the company is operating a temporary plant.

WINNIPEG, MAN., CAN.—The contract for furnishing and installing 46,000 ft. of 13,000-volt, three-core cable has been awarded by the Board of Contract to the Canadian British Insulated Company, of Montreal, Que., Can., for $51,520.

BOTHWELL, ONT., CAN.—The Urban & Rural Telephone Company, recently incorporated with a capital stock of $4,000, is planning to erect a telephone system, which will serve the town of Bothwell, the townships of Zone, Oxford, Euphemia and Mosa. The main office will be located in Bothwell.

COCHRANE, ONT., CAN.—Preparations are being made by Beach Brothers to install an electric plant in Cochrane to supply electricity for lamps and motors in the town.

GUELPH, ONT., CAN.—At an election to be held Sept. 26 a proposition to appropriate $85,000 for extensions and improvements to the Guelph railway system will be submitted to a vote.

LONDON, ONT., CAN.—Contracts amounting to $16,000 have been awarded by the Water Commissioners for electrical equipment for the Springbank pumping plant to the Canadian Westinghouse Company, the Allis-Chalmers Company, Seamans Brothers and John McDougall & Company.

OTTAWA, ONT., CAN.—Arrangements have been made by the Hydro-Electric Power Commission and the Electric Commission of Ottawa with the Ottawa & Hull Power Company to supply the City of Ottawa with 1500 hp additional at $15 per horse-power delivered in Hull. The contract just completed will make the city's supply 4000 hp.

TORONTO, ONT., CAN.—The Board of Control has reported in favor of the purchase of the Toronto Railway Company to be operated as a municipal enterprise, also that the city engineer be instructed to prepare plans for new lines to the suburbs.

SWIFT CURRENT, SASK., CAN.—Sealed tenders will be received by G. W. Bilbrough, secretary and treasurer, until Sept. 27 for construction of power house and equipment as follows: Contract "C"—Power house. Contract "D"—Settling tank and intake. Contract "E"—Pumping machinery (compressed air system). Contract "F"—Electrical machinery. Contract "G"—Producer gas plant. Plans and specifications may be seen at the town hall, Swift Current, or at the office of J. Darlington Whitmore, engineer, 104 Willoughby and Duncan Block, Regina. Copies of plans and specifications for contracts "C" and "D" will be forwarded by the engineer upon receipt of check for $10, which will be refunded upon return of the plans and specifications.

## New Industrial Companies.

THE CENTRAL ELECTRIC COMPANY, of Memphis, Tenn., has been chartered with a capital stock of $6,000 by Charles J. Hasse, W. P. Battie, W. T. Overton and others. The company proposes to manufacture and deal in electrical supplies.

THE CHICAGO ACME CLEANER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $100,000 by C. H. Wolf, G. F. Nicklaus and M. Fulkerson, of Chicago, Ill. The company proposes to manufacture vacuum cleaners and operate the same.

THE DAYTON ELECTROMOBILE COMPANY, of Dayton, Ohio, has been chartered with a capital stock of $250,000 by John L. Baker, William Pflum, H. B. Brentlinger, George L. Baker and C. W. Dale, all of Dayton, Ohio.

THE DIFFERENTIAL POWER CLOCK COMPANY, of Chicago, Ill., has been incorporated by H. A. McLindon, E. D. Bacci and C. S. Hamilton, of Chicago, Ill. The company is capitalized at $100,000 and proposes to manufacture mechanical devices.

THE IMPROVED BLOCK RAILWAY SIGNAL SYSTEM, of Hammond, Ind., has been chartered by Charles D. Anderson, Howard Ross and Cornelia S. Benepe. The company is capitalized at $50,000 and proposes to manufacture block signal systems.

THE McCARTHY ENGINEERING CORPORATION has filed articles of incorporation with the Secretary of State at Dover, Del., with a capital stock of $100,000. The incorporators are: P. A. McCarthy, F. McCarthy, both of Houston, Tex., and H. W. Davis, of Wilmington, Del.

THE MERIT MOTOR CAR MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture motors, engines, etc., and also automobiles. The incorporators are: E. H. Knight, J. H. Riviere and E. C. Billings, all of New York, N. Y.

THE MONOBRAKE COMPANY, of Babylon, N. Y., has been incorporated by P. Krause, W. G. Nicoll and D. Sandman, of Babylon, N. Y. The company is capitalized at $125,000 and proposes to manufacture and deal in brakes, equipment and supplies for autos, etc.

THE NATIONAL HYDRAULIC CONSTRUCTION COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $500,000 to do a general contracting and building business, etc. The incorporators are William D. Johnson, 26 State Street, Hartford, Conn.; Edward del Castillo, 154 East Ninety-first Street, New York, N. Y., and H. L. Zeigler, 5 White Street, New York, N. Y.

## New Incorporations.

SOUTH SHORE, S. D.—Articles of incorporation have been filed for the Dexter-Germantown Telephone Company by E. O. Ellingson, T. N. Bergdon, J. C. Johnson and Anton Klix. The company is capitalized at $20,000.

MADISON, VA.—The Madison Telephone Company, of Madison, Va., has been incorporated with a capital stock of $5,000. The following officers have been elected: J. B. Graves, president; M. L. Hoffman, vice-president; G. L. Gibbs, secretary, all of Glory, Va.

SPENCER, VA.—The Southeastern Telephone Company has been incorporated with a capital stock of $5,000. The officers of the company are: D. S. Bill, president; D. E. Moore, vice-president; W. C. Clanton, secretary, and G. W. Clark, treasurer.

FLAT ROCK, W. VA.—The Flat Rock Independent Telephone Company has been chartered with a capital stock of $5,000 for the purpose of constructing and operating a telephone system in Mason and other counties. The incorporators are: C. D. Dent, of Flat Rock, W. Va.; J. E. Carson, of Greer, W. Va.; G. W. Board, of Letart, W. Va.; C. W. White, of Leon, W. Va., and others.

## Personal.

*MR. JOHN B. MILLIKEN,* controller of the Crocker-Wheeler Company, has accepted the position of treasurer of the Yale & Towne Manufacturing Company, of Stamford, Conn. Mr. Milliken's headquarters will be in New York.

*MR. JOHN P. MOORE,* formerly instructor in electrical engineering at the Pennsylvania State College, is again with Mr. Robert P. Woods, consulting and constructing engineer, of Indianapolis, and is now located at Roswell, N. M., as electrical engineer on extensive irrigation projects in the Southwest.

## Trade Publications.

A BEAUTIFUL FIXTURE CATALOG.—A specimen of book-making that would adorn the collection of a bibliophile has been issued by the Pettingell-Andrews Company, of Boston, with the title "Lighting Fixtures for the Home, the Church and Public Buildings." The large size of page—12 in. x 15 in.—enables the excellent illustrations to be displayed with artistic effect, which is enhanced by good printing on a superior quality of plate paper. The binding is equally successful, the velvety leather of the back being excellently matched by the board covering and end papers. The work is further ornamented by four full-page views of large and handsome interiors, showing fixtures in place, the engravings having the effect of eau-forte etchings. As a specimen of good taste in book design and skill in execution the work could safely be exhibited alongside of the best productions of the American press, and we offer our congratulations to those concerned in the

achievement, namely, Mr. Levor, manager of the company's fixture studio, who is credited with the original plan of the book; Folsom & Sunergreen, who made the fixture engravings; G. Fred Crosby, who designed the decorations of the introductory pages and drew the four interior views above noted, which were engraved by the Hub Engraving Company; and last, but not least, the Barta Press, of Boston. The catalog is divided into five sections, namely, Colonial, English, French, Commercial and Glassware. About 250 fixtures are illustrated in the artistic sections, and about half that number of stock types in the commercial section.

CONDENSERS FOR SMALL CENTRAL STATIONS.—With this title the Wheeler Condenser & Engineering Company, of Carteret, N. J., has reprinted in pamphlet form a lecture delivered before the Missouri Gas, Electric & Street Railway Association. It contains a number of useful tables, charts and curves relating to the operation and economy of condensing machinery. The effect of vacuum on the steam consumption of simple slide valve, compound, high speed and low speed engines and steam turbines is first discussed, and then the other economies to be obtained by using condensing machinery, and, for instance, the reduction in boiler capacity, are taken up. With respect to jet condensers, a report of two tests is given, showing the advantages of the counter-current construction of the Wheeler rectangular jet condenser as affecting economy of operation and the attainment of high vacuum. The subject of air pumps is also considered, a typical indicator card from a dry air pump being reproduced. Under the heading "Surface Condensers" several pages are devoted to the various factors which influence the transmission of heat through condenser tubes and their bearing on the economy of a surface condenser.

## BUSINESS NOTES.

THE GARWOOD ELECTRIC COMPANY has appointed Hugh A. Brown manager of its Chicago office, with offices at 555 Old Colony Building. Mr. Brown has during the past eight years been actively engaged in the sale of electrical machinery in Chicago and Cincinnati, and brings a technical training to the work of the company in forwarding the special application of motors and generators to industrial purposes of all kinds.

H. W. JOHNS-MANVILLE COMPANY OPENS NEW OFFICES.—Owing to the vicinity of Atlanta, Ga., and Rochester, N. Y., the H. W. Johns-Manville Company has recently opened a new office in each of these cities. The Atlanta office is located in the Empire Building, in charge of Mr. W. F. Johns, who has been traveling this territory for the company for a number of years. The Rochester office is located at 725 Chamber of Commerce, in charge of Mr. H. P. Domine, formerly with the Buffalo branch of the company.

MATHIAS KLEIN & SONS, manufacturers of linemen's and electricians' tools, Chicago, report that they are busy in both their old factory on Van Buren Street and the new factory on Clybourn Avenue. The Van Buren factory is now almost exclusively employed in the production of "Klein pliers" of various styles and sizes, side-cutting, long-nose, oblique-cutting, flat-nose, weaver-nose, burner pliers and gas pliers, for which there is an ever-increasing demand. The Clybourn factory is employed in the production of the various items comprised in the general line of the firm's products.

THE CONNECTICUT TELEPHONE & ELECTRIC COMPANY announces that the sales arrangements that have existed between the United Manufacturers and the Connecticut Telephone & Electric Company and the Connecticut Shock Absorber Company will be discontinued on Oct. 1. After that date inquiries should be addressed direct to the Connecticut Telephone & Electric Company and the Connecticut Shock Absorber Company at Meriden, unless such information refers to settlement of accounts for purchases up to Oct. 1, in which case such inquiries should be addressed to the United Manufacturers at New York.

THE LAGONDA MANUFACTURING COMPANY, of Springfield, Ohio, announces that it has bought out the Enterprise Machine Manufacturing Company, acquiring the rights and patents for the full line of water strainers and tube cleaners manufactured by the latter. Special attention is being paid to the development of the water strainer. Although this strainer has been on the market for several years and is well beyond the experimental stage, the Lagonda Manufacturing Company has made several important improvements and the apparatus is now known as the Lagonda-Enterprise strainer. This strainer is suitable for removing impurities from boiler feed water, circulating water, etc.

McGILL MANUFACTURING COMPANY.—The Crescent Company, manufacturer of electrical specialties, announces that on Oct. 1 it will change its name to the McGill Manufacturing Company. The main office will be at the factory at Valparaiso, Ind., where the company has just completed a new two-story brick factory building containing 15,000 sq. ft. of floor space. There will be no change in the policy or ownership of the business as conducted by the Crescent Company. Mr. J. H. McGill will continue as president and general manager and Mr. H. W. Harrold as treasurer of the company. The Chicago office at 516 West Monroe Street will be continued for the convenience of Chicago trade. This office will be under the management of Mr. F. R. Bryant.

THONER & MARTENS.—Mr. Peder C. Thoner, who for about twenty-one years has been associated with the Albert & J. M. Anderson Manufacturing Company, for the last fifteen years as foreman and superintendent, and Mr. Rudolph Martens, who has been with the same concern for seventeen years, the past ten years as foreman in charge of special and experimental electrical work, have formed a co-partnership under the firm name of Thoner & Martens for the purpose of establishing a machine shop for the manufacture of switches, switchboards, electrical machinery, specialties, experimental work and for general machine work. The shop will be located at 37 Hartford Street, Boston, Mass., near Fort Hill Square, and will be equipped with the best up-to-date machine tools.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 13, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

969,773. PROCESS OF PRODUCING ALLOYS AND THE SEPARATION OF METALS; P. F. Cowing, New York, N. Y. App. filed Nov. 11, 1909. Metallurgical process for the electrolytic treatment of copper and nickel alloys by bringing the original alloy into solution electrolytically, substituting nickel and iron for the copper in the solution by selective deposition and cementation and then electrolytically depositing the nickel and iron.

969,774. INTERCOMMUNICATING TELEPHONE SYSTEM; H. D. Currier, Chicago, Ill. App. filed Nov. 23, 1907. A transmitter and receiver are in series with each other and a retardation coil of low resistance and high impedance is in shunt with the receiver permitting an increased flow of direct current through the transmitter and a ringing circuit supplied with current through a resistance in shunt with the receiver, the retardation coil being cut into and out of circuit when the receiver is connected with the local line and the trunk line respectively.

969,781. AUTOMATIC ELECTRIC HEAT CONTROL; H. G. Geissinger, New York, N. Y. App. filed Dec. 22, 1909. For electric heater circuits, including a circuit closer with an armature and energizing coils including lifting and retaining coils which raise the armature, the lifting coil being short-circuited by the armature when raised.

969,787. PLUG SWITCH; H. E. Leppert, New Britain, Conn. App. filed May 5, 1909. A plug with contact surfaces extending in the direction of the axis, one member cup-shaped and the other fitting therein and a support for the contact located in proximity to the outlet edges of the surfaces, said contact being connected to said support by a sliding connection so as to be transversely movable with relation to the support.

969,790. DYNAMO-ELECTRIC MACHINE; E. Mattman, Norwood, Ohio. App. filed Aug. 1, 1907. A field yoke of magnetic material with a detachable flange having ventilating opening between the poles.

969,796. BRUSH FOR DYNAMO-ELECTRIC MACHINES; E. T. Mug, Norwood, Ohio. App. filed Sept. 19, 1904. A carbon brush, the strands at one end being separated and embedded in the brush.

969,799. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM; J. L. McQuarrie, Oak Park, Ill. App. filed Nov. 28, 1907. Secret system, the trunk line terminating into an intercommunicating system connectible at each station with the trunk line with a circuit-closing device also located at each station for completing the trunk line irrespective of the telephone set.

969,805. OUTLET BOX; C. T. Pratt, Frankfort, N. Y. App. filed June 7, 1909. A plug for closing the conduit openings consisting of a disk of slightly larger diameter than the aperture to be closed, the edge of the disk being upset to provide a flange on each side of the disk and formed on a plane oblique to that of the disk, one face being of less diameter than the aperture to be closed so that the flange can be set up after the disk is inserted in the aperture to retain the disk in place.

969,809. ALTERNATING-CURRENT MAGNET; A. Simon, Milwaukee, Wis. App. filed Oct. 8, 1906. A plurality of coils in axial alignment with a magnetic frame forming magnetic circuits for said coils in the same plane.

969,813. CIRCUIT BREAKER; H. L. Van Valkenburg, Norwood, Ohio. App. filed June 16, 1906. An oil switch or circuit breaker with automatic tripping mechanism to open the switch.

969,814. SEARCHLIGHT PROJECTOR AND THE LIKE; H. Viertel, Berlin, Germany. App. filed Mar. 10, 1909. An arc light with mirror with the positive electrode near the focus and a thinner negative electrode curved between the focus and the mirror.

969,816. TERMINAL CASING; H. L. Wallau and E. E. Noble, Cleveland, Ohio. App. filed Aug. 23, 1909. For junction boxes in which an insulating body has an upward socket with openings and a terminal block is secured to the body above each opening and a wing extends from the body between each pair of openings acting as insulating barriers for the prevention of arcs.

969,818. TELEPHONE DROP; A. H. Weiss, Chicago, Ill. App. filed Nov. 25, 1907. An armature with a pivot and a drop catch having flexible members supported by the pivot, one of the flexible members engaging the armature.

969,824. ELECTRIC SWITCH; G. S. Williamson, New York, N. Y. App. filed March 10, 1910. For linotype machines with knee shift for the switch. Details.

969,832. TELEPHONE APPARATUS; G. Babcock, Rochester, N. Y. App. filed July 11, 1907. A magnet and coil with diaphragm, having their convex sides in engagement consisting of plates compressed to form a laminated structure.

969,833. PRODUCTION OF FERRIC SALTS; A. G. Betts, Troy, N. Y. App. filed Jan. 7, 1909. Electrolytic method consisting in electrolyzing the solution with an insoluble anode while maintaining it at a temperature between 50 and 100 deg. C.

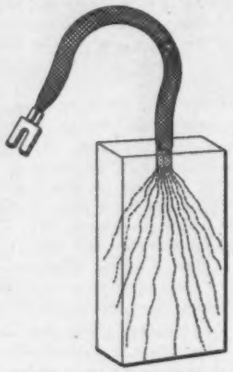
969,849. PORTABLE ELECTRIC HEATER; F. L. Dyer, Montclair, N. J. App. filed May 25, 1909. A heating coil within the heater and plug and connections and a chamber for enclosing the plug, and connections when not in use so that it may be carried about in the pocket until used.

969,866. MOTOR STARTER; C. T. Henderson, Pittsburgh, Pa. App. filed Jan. 13, 1906. A plurality of electromagnetic windings energized successively with a plurality of relay switches, one for each winding, arresting the successive operation thereof, and an electromagnet for actuating all of the switches.

969,876. SECONDARY BATTERY; G. J. Johnson, Chicago, Ill. App. filed March 28, 1910. "Hatch" battery consisting of a pair of compound elements each composed of pairs of porous plates with insulating edges and electrodes with their edges exposed to the action of the electrolyte, the plates having channels for the electrolyte.

969,892. COMMUTATOR BAR AND LEAD; C. E. Lord, Milwaukee, Wis. App. filed Dec. 21, 1908. A commutator bar with grooves and an aperture connected therewith with a connector passing through the aperture and setting in the grooves to form a loop and means for clamping the connector together beyond the loop.

969,894. METHOD OF AND MEANS FOR CONTROLLING REGENERATIVE ELECTRIC MOTORS; R. Lundell, New York, N. Y. App. filed Dec. 21, 1909. For operating a plurality of series motors



969,796.—Brush for Dynamo Electric Machines.

969,849.—Portable Electric Heater.

to drive a common load by connecting the motors to the line with each field coil in series with its armature and impressing independent voltages upon the field circuits and regulating the latter by varying their resistance.

969,921. ELECTROLYTIC APPARATUS; W. Thum, Hammond, Ind. App. filed Nov. 22, 1909. A tank with an inclined floor and an anode cell in the tank above the higher part of the floor with a perforated bottom and sides and an anode basket within the cell with a filtering bottom.

969,985. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed June 26, 1908. Railway system with a central station and telephone system for signaling and substations along the line with a signal at each substation, a selecting device therefor, and an electromagnetic means for operating the selecting device in each line at each signal receiving station and a shunt circuit transparent to the telephone currents bridged around the electromagnetic means.

969,993. ELECTRIC IGNITING DEVICE FOR GAS STOVES; C. Stamm, Milwaukee, Wis. App. filed March 16, 1908. A valve for the gas pipe carrying a swinging arm, and operated by a sliding bar and an electric igniter for the burner.

969,994. TROLLEY RETRIEVER; W. C. Starkey, North East, Pa. App. filed Nov. 23, 1908. A case with a stop and retrieving disk actuated by a spring tensioned by a rope to retrieve the trolley.

970,015. COVERING FOR MOUTHPIECES OF TELEPHONE TRANSMITTERS; A. K. Cann, Watkins, Col. App. filed Oct. 18, 1909. A thin disk of two portions that can be folded together, one portion embracing the neck of the transmitter and the other covering the mouth.

970,066. TELEPHONE TRANSMITTER; O. M. Leich and N. Pedersen, Genoa, Ill. App. filed June 19, 1908. A body with a diaphragm and bridge, leaf springs pressing against the diaphragm so arranged as to produce a long spring action.

970,078. INSULATOR; J. A. Meurling, Chicago, Ill. App. filed March 19, 1910. A cylindrical body with an opening for the pin, a wire groove on the outer surface and posts separated from the circuit to kink the wire in contact with the insulator.

970,087. BINDING DEVICE FOR CIRCUIT CONDUCTORS; T. E. Murray, New York, N. Y. App. filed March 10, 1910. Two plates with hook-shaped edges seated one within the other and overlapping flanges with a clamping screw passing through the flanges to engage a conductor seated in the hook.

970,088. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed June 16, 1910. A base with sockets and terminals and auxiliary fuse and removable fuse plug entering the sockets and closing the circuit between the terminals through the fuse.

970,089. BINDING POST; T. E. Murray, New York, N. Y. App. filed June 22, 1910. A bifurcated shank with sleeve thereon and a plurality of pairs of opposite recesses in its edge, each pair differing in size from the recesses of the other pairs and the wire to be held being arranged in a pair of recesses between the sleeve and the bottom of the shank.

970,124. CIRCUIT CLOSER FOR ALARMS; F. A. Schultz, Wilkes-Barre, Pa. App. filed Feb. 26, 1910. For burglar alarm circuits, including rods with a contact button, and an open alarm circuit connected to the button and one rod, an armature sliding on the rods and coiled springs on the rods actuating the armature to close the circuits.

970,149. APPARATUS FOR GALVANIZING METAL TUBES, RODS, ETC.; F. Werth, Milan, Italy. App. filed Dec. 11, 1909. An electrolytic vat, a driving shaft operating an endless carrier, carrying rings supporting the objects to be plated.

970,169. ELECTRICAL PROTECTIVE APPARATUS; J. A. Birsfield, Rochester, N. Y. App. filed July 18, 1907. For telegraph lines to protect from sneak currents by means of a lightning arrester and ground springs and a thermal device or fuse operating between the apparatus spring and the second ground spring.

970,180. ELECTROMAGNETIC DEVICE; W. S. Burnett, Milwaukee, Wis. App. filed April 12, 1909. An electromagnetic coil with a plurality of magnetizable core pieces separated from each other, each core controlling a separate device.

970,194. SLEEVE CABLE TERMINAL; R. S. Donaldson and V. E. Furnas, Louisville, Ky. App. filed Aug. 3, 1908. A distributing terminal with a common lead sleeve with wiped joints and an integral receptacle containing a fusible insulated compound.

970,200. INDICATOR; C. Emsheimer, New York, N. Y. App. filed Sept. 24, 1909. A casing with horizontal and aligned portions and a vertical central portion, hinged back and transparent front with an electric lamp bracket on the back.

970,204. GAS TURBINE; E. A. Forsberg and B. Jaungstrom, Stockholm, Sweden. App. filed April 13, 1907. Two oppositely rotating vane systems with a direct-current generator connected to each and counteracting speed regulators connected to the systems which change when the speed varies and a circuit regulator operated thereby to regulate the exciting circuit of the fields in proportion to the speeds.

970,211. TROLLEY BASE; C. E. Gierding, Newark, N. J. App. filed June 7, 1909. A push and stop for a trolley base including a turret with a pivot socket, a strut socket, tensile springs and buffer springs.

970,215. PREPARATION IMPERMEABLE FOR ROENTGEN RAYS; O. Gros, Leipzig, Germany. App. filed June 29, 1910. For medical use, consisting of a mixture of white bolus coated with bismuth oxid, to be applied to the body in X-ray work.

970,233. COMMUTATOR CONSTRUCTION; F. Jeffrey, Milwaukee, Wis. App. filed Oct. 25, 1909. Composed of segments with an undercut slot on the interior, the segments being clamped between their ends by clamping rings and wedges.

970,255. PULL SOCKET FOR ELECTRIC INCANDESCENT LAMPS; J. L. Moore, New York, N. Y. App. filed Nov. 17, 1909. An insulating block carrying a post which carries a rotatable sleeve having teeth actuated by a pull cord and actuating a sliding socket which moves the switch.

970,264. DOOR SWITCH; J. G. Peterson, Hartford, Conn. App. filed Nov. 3, 1909. A spring with a push-button having an inner section connected with the actuating mechanism and a movable outer section, a spring being arranged between the two sections.

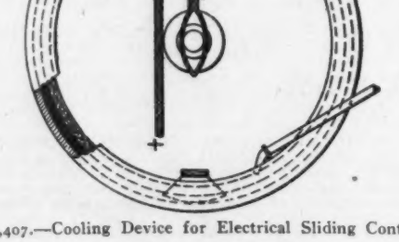
970,288. TELEPHONE REPEATER; C. Adams-Randall, New York, N. Y. App. filed April 15, 1905. Two independent normally closed main line circuits, each having means for opening and closing the other.

970,296. PROTECTED OR ARMOR-CLAD ELECTRIC SWITCH FUSE; H. H. Berry and W. J. Markham, London, Eng. App. filed June 9, 1910. A hand lever which pushes on and pulls off the switch blades, said lever being provided on either side of the case containing the switch, and a cover for the metal case, said cover carrying switch blades.

970,367. TRANSMITTER FOR TELESELECTERS; E. Blos, Schoneberg, near Berlin, Germany. App. filed Sept. 27, 1909. For automatic telephone exchanges for transmitting signals by means of a transmitter and divided local starting circuit for a controller, a relay in each branch and groups of contacts for producing a different succession of impulses with each group and a movable contact therefor, manually operative.

970,377. JUNCTION BOX; M. Laux, Pittsburgh, Pa. App. filed Dec. 20, 1909. A junction box with casing and shell within the casing, insulated cells within the shell carrying contact blocks, and a plug connecting pairs of blocks of each cell together.

970,407. COOLING DEVICE FOR ELECTRICAL SLIDING CONTACTS; B. Von Ugrimoff, Moscow, Russia. App. filed July 12, 1909.



970,407.—Cooling Device for Electrical Sliding Contacts.

An inwardly opening, revolving container with a revolving liquid conductor therein, and a stationary conductor in the liquid with a nozzle for spraying a second liquid into the container, particularly for unipolar dynamos.

970,410. CIRCUIT SWITCH; L. Wilson, Detroit, Mich. App. filed Feb. 3, 1910. For automobiles, including a key with wings to prevent the unauthorized insertion of a strange key.

970,412. ELECTRIC MOTOR; E. Arnold, Karlsruhe, Germany, and J. L. La Cour, Vesteras, Sweden. App. filed Oct. 5, 1908. A rotor with a commutator with brushes in two sets, the second set of brushes short circuiting the rotor winding on a line displaced from the first set and forming the compensating circuit, together with an auxiliary stator winding for producing magnetization along the line of the first set of brushes and means for varying the voltage per turn of the main winding.

970,420. STORAGE BATTERY; R. N. Chamberlain, Depew, N. Y. App. filed Dec. 8, 1906. Tray battery of sheet lead plates separated by insulators.

970,449. TELEPHONE ATTACHMENT; A. C. Hewitt and W. C. Thomas, Philadelphia, Pa. App. filed April 14, 1910. For supporting the receiver by means of an adjustable bracket arm, which also contains the receiver hook.